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Le projet doit permettre d'enseigner de façon programmée à un étudiant du collégial comment dériver toutes les fonctions pertinentes à un cours d'introduction du type Calcul différentiel et intégral I (201-103). Un court rapport (deux pages) présente l'état du projet à la fin de 1978: réaction positive des étudiants à une première expérience au printemps 1978; retards dûs à des modifications dans le matériel informatique. Ce rapport est complété par une reproduction du "Manager's manual" (The package - Instructions for the manager - Data for the programmer - Variable listing of variables assigned). Une proposition pour la prolongation du projet complète le tout: tracés des fonctions mathématiques (phase V) et production par ordinateur de tests et d'examens (phase VI).

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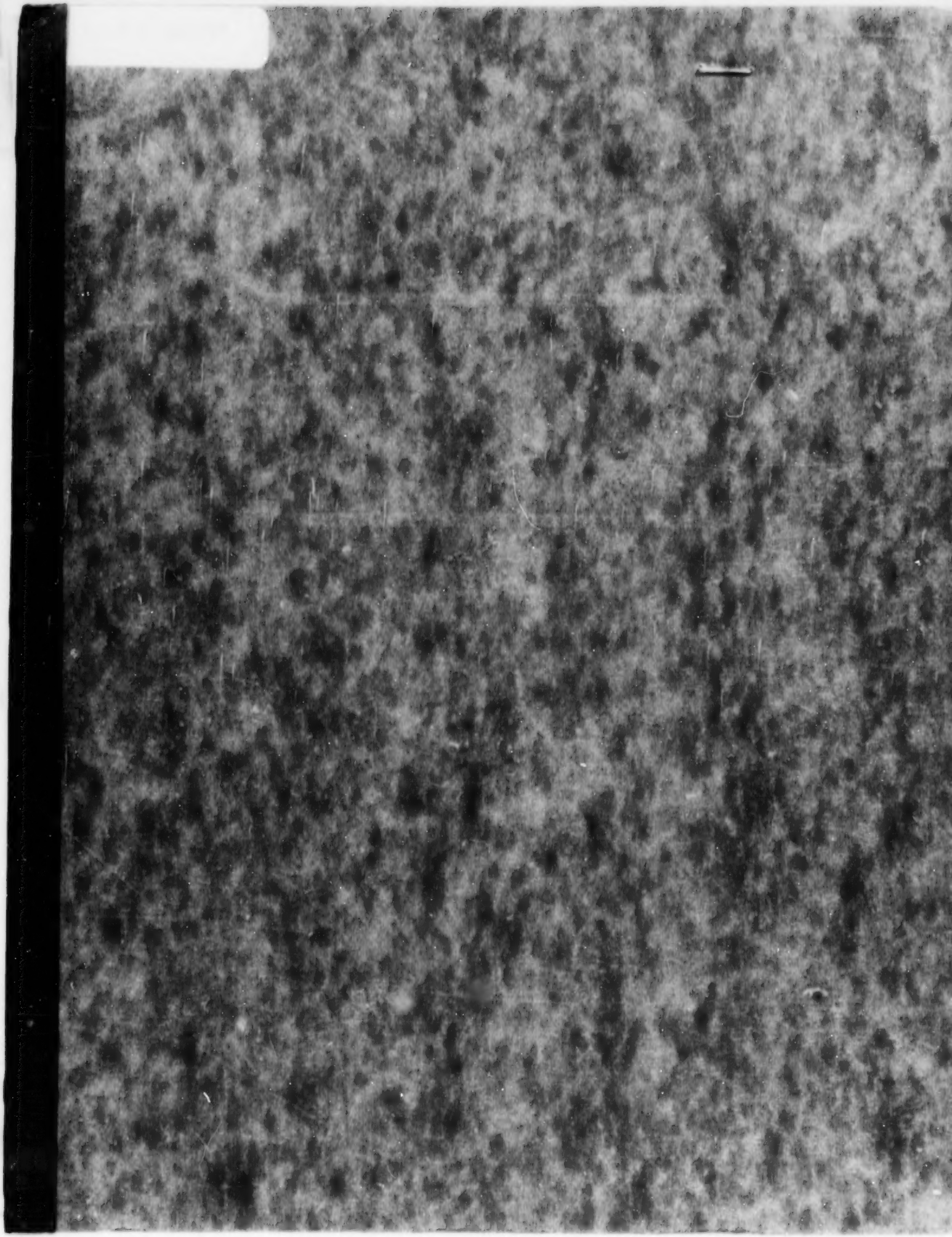

E D U Q 8270157

R A P P O R T I N T E R I M A I R E

Le 26 février 1979

ENSEIGNEMENT ASSISTE PAR ORDINATEUR (EAO)

Enseignement Complementaire et Individualisé du Calcul (ECIC)

Nikolai Arganski, Auteur
Robert Mearns, Suppléant

CEGEP JOHN ABBOTT COLLEGE

Recherche et développement prioritaire: A 4, recherche pédagogique et innovation - technologie éducationnelle

Enoncé des objectifs

Ce projet permettra d'enseigner à l'élève commençant en Calcul (tel le Calcul différentiel et le Calcul intégral 201-103-73), comment dériver toutes les fonctions pertinentes à un cours d'introduction.

Etat du projet

a) Les deux premières phases du projet furent complétées et soumises à des tests en classe des le mois de juin 1978 tel que planifié.

b) Au cours de l'été 1978, le programme prévu fut bouleversé à cause de circonstances imprévues:

   i) le collège a changé son H.P. 2000 Access pour un ordinateur H.P. 3000

   ii) En même temps, le personnel-chef du centre des calculateurs est parti du collège, ce qui a gravement embarassé le personnel pédagogique qui travaillait à se familiariser avec le nouveau système. Ainsi beaucoup plus de temps qui prévu fut dépensé à récrire les programmes.

c) En ce moment, les programmes pour les Phases I et II, sont récrits et nous sommes actuellement à en faire le "de-bugging".

d) Ces retards ont eu un effet négatif sur le progrès des Phases III et IV du projet; il est donc peu probable qu'elles seront terminées pour la date proposée originalement, soit juin 1979; mais nous espérons reprendre le temps perdu au cours de l'été 1979 et finir en temps pour pouvoir faire des tests en classe en septembre 1979.

Analyse Statistique

Les notes du Calcul I pour le semestre du printemps 1978 furent soumises à une analyse statistique (voir les exemples d'analyse statistique dans le "Manager's Manual"). Les résultats ont démontré que le groupe expérimental a mieux reussi et de façon marquée qu'au moins l'un des autres groupes au cours de ce semestre.

Le collège a depuis obtenu un paquet de statistiques du H.P. 3000 sur lesquels les tests futurs s'appuiront.

..... 2

Réaction des étudiants à la méthode

Les étudiants semblent favorables au ECIC. A la fin du semestre du printemps 1978, on a fait remplir un questionnaire par la classe expérimentale qui a donné les résultats suivants:

a) 20 sur 24 étudiants inscrits étaient présents

b) 17 sur 20 présents ont indiqué qu'ils utilisent le ECIC

c) 9 sur 17 qui s'en sont servi l'on trouvé très bon pour les élèves lents et rapides.

d) 2 sur 17 l'ont trouvé bon pour les deux catégories

e) 1 sur 17 l'a trouvé très bon pour l'élève rapide, mais était indécis pour ce qui est de celui apprend lentement

f) 2 sur 17 ont trouvé qu'il était bon pour les élèves rapides mais étaient indécis pour ce qui est des élèves lents.

g) 2 sur 17 étaient indécis pour les catégories

h) 1 sur 17 trouvait qu'il n'était pas bon pour l'élève lent et était indécis pour l'élève rapide.

Documentation du projet

Les Phases I et II du projet ont maintenant:

a) Un exemplaire du "Manager's Manual" attaché à ce rapport

b) Un "printout" complet des programmes pour les Phases I et II, attaché à ce rapport

c) Une explication sur bande sonore des Phases I et II pour le H.P. 2000 Access conservée au collège John Abbott

THE INTERACTIVE DERIVATIVE SOLVING SYSTEM

MANAGER'S MANUAL

Enseignement assisté par ordinateur

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PART I

THE PACKAGE

HISTORY OF THE PROJECT

In the fall semester of 1976 the following situation was at hand in John Abbott College:

a. The college had recently aquired a time-sharing H.P.3000 Access computer.

b. The mathematics department used the computer only for its Computer Science courses.

c. There were on campus several students with extensive knowledge of programming, who devoted their energies largely to computer games.

d. Calculus I was the first "difficult" required math course for all Health and Pure&Applied Science students.

e. The "Open Door" policy of the math department induced many below-average students to confront their instructors with "endless" routine questions. Yet, there were others - some 20% of the Calculus I students - who felt too embarrassed to ask "dumb" questions and proceded quietly to fail the course.

f. Evidently, there was a need for an efficient package (system) for solving the typical "dumb" questions which so often are an embarrassment to students and a time--consuming chore for teachers.

Thus, to remedy the situation, and to make better use of the existing recources, the INDIVIDUALIZED SUPPLEMENTARY CALCULUS INSTRUCTION (ISCI) - a D.G.E.C. (Direction générale de l'enseignement collégial) financed project - was launched in the spring semester of 1977. In spring semester of 1978 the first two phases,of the six-phase project, were completed and class--tested on a limited scale (for results see Evaluation of this package).

Phases I & II of ISCI cover the differentiation presented in Cal. I, Phase III - Integration, Phase IV - applied prob-

lems, Phase V - graph plotting, and Phase VI - computer produced Individualized Tests.

A unique feature of ISCI is the IDSS - the Interactive Derivative Solving System. Developed by several gifted JAC students, the IDSS can identify and differentiate any of the functions encountered in the Cal.I course - including the exponential, logarithmic and the trigonometric functions.

Other features of the package are:

i. It requires no knowledge of computers behind the sign on procedure.
ii. It does not enter into the grading process in any way.
iii. Provides for extended availability of assistance i.e. during evenings and on weekends.
iv. Provides efficient assistance to those students who need the most help - the slow-learners.
v. Provides a "human touch" by calling the students by their first names and by sending them encouraging messages.
vi. Furnishes the instructor with a list of student comments.
vii. Provides the instructor with a list of frequency (date, time, duration) of use of the package by each student.

HOW DOES IT WORK (As seen by the student)

On signing on , the student receives the following message:

"HELLO
Welcome to Computer-Aided Calculus I ...
I'd like to get to know you, so what I'd like you
to do is to type in your first and last names for me.
After you've finished ty ping it in, press the button

marked 'RETURN' (It's located at the lower right of the keyboard.)"

NOTE: For conciseness of explanation, in what follows, the students response will be prefixed with X: and the sy stem response with a "Y;".

X; NICK ARGANSKI

Y: "Well Nick, I need to know your student I.D.number. Please type it in below, and don't forget to press the 'RETURN' key when you are finished."

Notice, that from the very beginning an atempt is being made to make the student feel at ease by calling him/her by the first name; at the same time, in anticipation of his further problems he is being tought that to get any where he must press the return button.

The next stage of the program differentiates between the first time user (who is supposed to type in 'Yes') and the returning student(who types in 'No').

Y: "Would you like instructions on how to use this program? (Type in 'yes' or 'no' and then press the button marked 'RETURN'.)"

Y: "Every now and then, I will type a ':'. This is because I probably type faster than you can read. When you've caught up with me, just press the button on the keyboard marked 'RETURN'. (You can try this now.)

:

Please note:

You can stop the program by typing in the word 'stop' or'STOP' when I type a ':'.

:"

The 'stop' was explained purposefully at the beginning of the instructions, so as to convey to the student the idea that he needs to stay onlyas long as he wants to, that the whole thing is completly voluntary, for his own benefit.

Next an attempt is being made to make the student feel that he is not just a passive recipient, but that he can contibute towards improvement of the system by giving his"valuable" comments.

Y: "If you want to make a comment about something, when I type a ':', you can enter your comment by typing the word 'com'.
:
I will respond with a '>', which is where you enter your comment.
Eg.
: Com
> Hi there, Bob Mearns.
If your comment will take longer than one line, don't worry. Just keep typing until you are finished. Then when you have nothing more to say, Just press the 'RETURN' button."

This complets the initial stage of the explanations. Next the student is shown how to choose the appropriate part of ISCI.

Y: "You may:
1. Differentiate a problem with the aid of the program.
2.Receive a problem from me to work on.
3. Enter a problem that we will work on together.
4. Stop the program.

Please choose one by entering 1,2,3,or 4

If you choose 1, you are able to enter a problem of your own that I will help you differentiate.

If you choose 2, I will give you a problem to differentiate, from a specific category. (If you don't know how to do it, I'll help you figure it out.)

If you choose 3, you may enter a problem that we will work at separately and on completion compare our answers.

This is how you enter a problem of your own (if you type 1).

The printer will skip a few lines and type:

WHAT VARIABLES WILL BE USED IN THE FUNCTION?

You will now enter first the INDEPENDENT variable and then any dependent variables that are in the function.

for example, if your independent variable is 'x' and your dependent variables are 'y' &'z', you would enter

xyz

or x,y,z

It doesn't matter if there is anything separating them, as long as the independent variable comes first. That is quite important if you want the problem to work outproperly. Notice, also, that capital-letter variables (X or Y) are different from lower-case variables (x or y). That too is important."

Students with a short concentration span could be getting tired by this stage, so the next sentence is thrown in to"rarefy the atmosphere a little bit".

Y: "At long last. How to type your function in. Thought you'd never get there, didn't you?

The printer will ty pe:PLEASE TYPE IN THE FUNCTION BELOW. This is precisely what you should do.

Eg. if your function is $y = 3x$, you would enter it as

3x

and then the 'RETURN' button, of course. I would then help YOU to solve the problem."

The last sentence is again intentional; as much as to say :"Do not worry , help is on the way." Next the student is told how to use the brackets and how to enter an exponent. This discussion is completed by the following summary:

Y: " Some good points about the format of your function.

1. Make sure that you have enough brackets. What you take for granted, I may not.

eg. x to the power of two thirds should be

x ^(2/3) ---- RIGHT

x ^2/3 ---- WRONG

I would evaluate "x 2/3 as $\frac{x\ ^2}{3}$

2. Asterisk will be rejected as garbage. A term such as "2x" is perfectly acceptable (In computer science an asterisk is used as a multiplication sign).

3. Sometimes you will make an error while typing in your function. If you haven't pressed the 'return' button, you can just type in control x (i.e. press the control button and the x button simultaneously) and re-enter your function. If you have already pressed the return button, S-O-R-R-Y -- You'll just have to sit out the printout

4. When you've finished with that function and the printer types WHAT VARIABLES WILL BE USED IN THE FUNCTION? again, you have the choice of either entering a new function or typing 'stop'.

Remember. Save your printouts. In addition to being helpful to you when you study, you can always look back

at them when you're eighty years old and sigh ..."Gee, remember when I was back in Cal I at John Abbott..."

Have fun."

This complets the second stage of the introductory explanations. The student is now considered to be ready to call up the programme and to make his choice of the mode of operation.

From the above presentation it should be clear to the reader that ISCI is aimed at the under-achiever; its pace is deliberately slow and as little as possible is being taken for granted in the explanations.

Let's look at a hypothetical "desperate" case , whose choice is "1" and whose function is $y = 3x^2$. After he made his choice, his printout will look as follows:

Y: What variables will be used in the function?
X: XY
Y: Please type in the function below.
X: Y = 3x ^2
Y: ' =' is garbage to me.
Please re-enter the function correctly.
X: 3X^2
Y: To differentiate this function we have to use power rule. Since we must use the power rule, let's look at the general form.

$$\frac{d}{dx} ax^n = na\ x^{n-1}$$

where 'a' is the coefficient, 'x' is the variable, and 'n' is the exponent of x.

In our case, the coefficient a is 3, the variable is X and the exponent, n, is two.
:

using the general form, we see that we have to multiply a by n. Since n is two, we just double a to get 6. Next, we calculate n-1, which is 2-1, which is just one. We then write down our variable, X, and raise it to the power of one. Since leaving out the exponent implies that the power is one, we simply won't write down the '^1' part.
:
So the derivative of 3X^2 is 6X.

If the student's initial choice is "?", it is assumed that he has achieved some mastery of the subject and consequently he wil get less explanation. However, for his initial choice he will get the simplest problem in the chosen cathegory. His typical printout will look as follows

X: 2
Y: Here are the categories of problems that I have:
1. Power Rule (Level I)
2. Power Rule (Level II)
3. Chain Rule (Level I
4. Product Rule (Level I)

Which category would you like a problem from?
X: 1
Y: Here is your problem:

4x

Please press return when you'v finished differentiating it.
X: 'RETURN'
Y: The derivative is

4

Is your answer algebraicaly identical?

X: Yes

Y: Would you like another example?

At this stage, if the answer is 'Yes', the cycle will be repeated with say : $4x^4$ 3, followed by $5x^{(7/4)}$ etc.
If the answer is "No", the program will switch itsef from this category back to the original four chices and the student can try something different. If, however, the students answer to the question: "Is your answer algebraically identical?" is "No", the program will respond with:

"Would you like me to go over the differentiation process with you?

and if the answer is "Yes", a detailed explanation will follow. If, on the other hand, the studen will request more and more problems of the same category, the following scenario will result:

Y: Would you like another example?

X: Yes

Y: I'm sorry, Nick, but you've done all of the examples in that category.
Would you like to choose another category?

X: Yes

Y: Which category would you like a problem from?

X: 3

Y: Here is your problem:

$$3(x^2 - 2x^3)^{(-3/4)}$$

Please press return when you'v finished differentiating it.

and the cycle will be repeated till further exhaustion occures.

If, at the beginning of the session, the student's choice is "3", the process that follows is simmilar to that of choice "2", except that this time the student will be presenting the

computer with his own peculiar chice of a problem.

Thus one can see that ISCI enables the student to start from humble beginnings and to finish with rather respectable knowledge of calculus. But perhaps the most important aspect of ISCI is the fact that it has the potential not only to rescue the would-be mathematics drop-out, but also help him to become a better human being, a more valuable member of our society, by adding an extra dimenssion to his development.

The students seem to respond favourably toward the ISCI. At the end of the 1978 spring semester, the experimental class was asked to fill out a questionair and the results were as follows:

a. 20 out of 24 registered students were present that day.
b. 17 out of the 20 present indicated that they used the ISCI.
c. 9 out of the 17 who used the ISCI thought that it was very good for both the slow and the fast learner.
d. 2 out of the 17 thought that it was good for both.
e. 1 out of the 17 thought that it was very good for the fast learner but was undecided about the slow learner.
f. 2 out of the 17 thought that it was good for the fast learner but were undecided about the slow-learner.
g. 2 out of the 17 were undecided about both.
h. 1 out of the 17 thought that it was no good for the slow learner and was undecided about the fast learner.

STATISTICAL ANALYSIS - EXAMPLES

In what follows, two examples of statistical analysis are presented and discussed.

TABLE I

LIST OF CLASSES AND GRADES FOR CALCULUS I, SPRING SEMESTER 1978

k_i / x_{ij}	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	63	69	50	31	74	80	27	60	92	52	82	75	60	92	48
2	60	60	69	72	65	60	93	97	89	71	45	74	73	70	66
3	68	10	27	44	84	53	89	46	60	92	75	46	82	67	90
4	84	53	80	79	81	86	44	60	20	74	32	60	50	73	14
5	70	37	47	60	74	46	94	92	85	56	77	68	64	52	76
6	60	37	43	61	69	73	91	73	82	83	75	74	98	71	79
7	53	49	66	65	42	89	71	42	95	56	53	16	79	46	60
8	67	86	65	89	23	84	90	61		82	60	81	68	87	73
9	89	61	60	91	55	93	80	92		65	68	70	87	93	77
10	64	72	72	60	66	54	66	66		95	79	83	60	72	84
11	38	35	55	83	70	60	72	61		70	75	84	71	67	56
12	60	60	76	67	27	83	85	94		71	69	67	68	31	60
13	83	43	60	33	64	31	60	93		85	87	60	20	91	67
14	40	39	40	26	42	72	60	99		63	25	82	29	60	71
15	62	73	72	77	71	42	64	66		92	68	84	72	73	93
16	86	33	54	86	86	52	87	60		97	69	39	35	78	78
17	70	77	54	82	26	19	81	60		83	62		68	21	80
18	63	46	75	73	75	52	87			33	67		55	80	77
19	86		41	77	69	86	86			15	81		81	56	100
20	63		74	10	82	18	46			66	77		69	50	
21	60			98	32	88	87			97	73		90	83	
22	48			68	72	17	51			60	66		72	76	
23	69			46	26	84	70			50	63		71	80	
24	83			883	67		93			72	76		54	72	
25					94		70			72	97		84	64	
26					93					68	61		94	60	
27					60					89	23				
28										63	78				
29										97	40				
30											85				
n_i	24	18	20	24	27	23	25	17	7	29	30	16	26	26	19
$\bar{x}_i$	66.21	52.22	59.00	65.04	62.56	61.83	73.76	71.88	74.71	71.34	66.27	66.44	67.46	67.88	71.00

EVALUATION

To evaluate this project it was decided to make a statistical analysis of the final grades of the students in the experimental group compared with all the other fourteen sections of calculus I for the spring semester of 1978. This was decided upon after a due consideration of the application of the pretest-posttest technique. The later was rejected due to the fact that only the first two phases of the project were ready for use and the students, thus, at best, would be tested for improvement in algebraic manipulations, which was not the aim of the project. However, it is planned to use the pretest posttest method at a later date - upon completion of all the phases of the project.

STATISTICAL ANALYSIS

The purpose of this statistical analysis is to use the analysis of variance (ANOVA) technique to inquire about the equality (pairwise) of the means of all the classes of Cal.I in the spring semester of 1978 with that of the experimental class.

Since the ANOVA technique assumes homogeneity, we will first check for same by the use of the Bartlett's test.

BARTLETT'S TEST

Null hypothesis H_o: $\sigma_1^2 = \sigma_2^2 = \ldots = \sigma_k^2$

H_a: non- homogeneity (at least one pair not equal).
Where k is the number of classes tested.

In this procedure the test statistic is:

$$B = 2.30259 \left((\log s_p^2) \left(\sum_{i=1}^{k} v_i \right) - \sum_{i=1}^{k} v_i \log s_i^2 \right)$$

$$\text{where } s_p^2 = \Sigma SS_i / \Sigma v_i = \Sigma (n_i - 1) s_i^2 / \Sigma v_i$$

The distribution of B approximates the chi-square distribution, with $k - 1$ degrees of freedom, but a more accurate chi-square estimate is obtained by computing C, the correction factor, with C given by

$$C = 1 + 1/3(k - 1) \left(\sum_{i=1}^{k} 1/v_i - 1/\sum_{i=1}^{k} v_i \right)$$

with the corrected test statistics being:

$$B_C = B/C$$

where v_i is equal to $n_i - 1$ and n_i is the size of class k_i (Zar p.131)

TABLE 2

CALCULATION OF CHI-SQUARE BY BARTLETT'S METHOD

Table 2 was constructed from Table I data.

k_i	SS_i	v_i	$1/v_i$	s_i^2	$\log s_i^2$	$v_i \log s_i^2$
1	4419.3	23	.04	192.1	2.28	52.52
2	6279.17	17	.06	369.41	2.57	43.65
3	3994.75	19	.05	210.25	2.32	44.13
4	11924.81	23	.04	518.47	2.71	62.44
5	11740.56	26	.04	451.56	2.65	69.02
6	13248.62	22	.05	602.21	2.78	61.15
7	7767.36	24	.04	323.64	2.51	60.24
8	5547.2	16	.06	346.70	2.54	40.64
9	4283.76	6	.17	713.96	2.85	17.12
10	10570.56	28	.04	377.52	2.58	72.15
11	9271.01	29	.03	319.69	2.50	72.64
12	5346.75	15	.07	356.45	2.55	38.28
13	8977.50	25	.04	359.10	2.56	63.88
14	7797.0	25	.04	311.88	2.49	62.35
15	6436.62	18	.06	357.59	2.55	45.96

$\Sigma SS_i = 117604.77$ $\Sigma v_i = 316$ $\Sigma 1/v_i = .83$ $\Sigma v_i \log s_i^2 = 806.18$

Now, $s_p^2 = \frac{\Sigma SS_i}{\Sigma v_i} = \frac{117604.77}{316} = 372.17$ and $\log s_p^2 = 2.57$

therefore, $B = 2.30259((\log s_p^2)(\Sigma v_i) - \Sigma v_i \log s_i^2)$

$= 2.30259((2.57)(316) - 806.18) = 13.68$

Where $SS_i = (s_i^2)(v_i)$, s_i is the variance and v_i is degree of freedom for class k_i

And $C = 1 + 1/3(k-1)(\Sigma\, 1/v_i - 1/\Sigma v_i)$

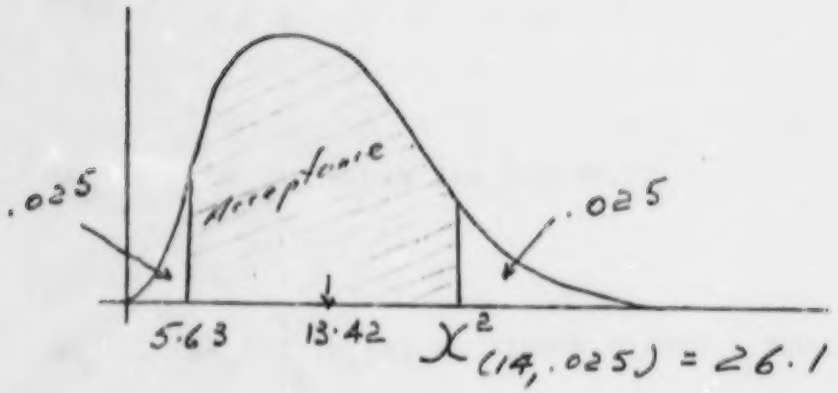
$= 1 + 1/3(14)\ (.83 - .00316) = 1.0196$

therefore $B_c = \frac{B}{C} = 13.68/1.0196 = 13.42$

= calculated chi-square

The tabulated chi-square (14,.025) = 26.1

Therefore null hypothesis is accepted, implying homogeneity.



Since homogeneity is assured and normality assumed, use of the standard ANOVA technique is appropriate. The following gives all relevant statistics for the above analysis.

H_o: $\mu_1 = \mu_2 = \ldots = \mu_{15}$

H_a: At least one pair not equal

$$C = \left(\sum_{i=1}^{t} \sum_{j=1}^{n_i} x_{ij}\right)^2 / \sum_{i=1}^{t} n_i = (21958)^2/331 = 1456657.897$$

* where t is the number of classes

$$\sum_{i=1}^{t} x_i^2/n_i = \sum_{i=1}^{t} n_i \bar{x}_i^2 = 1465831.507$$

$$SS_{TR} = \sum_{i=1}^{t} x_i^2/n_i - C = 1465831.507 - 1456657.897 = 9173.61$$

$$MS_{TR} = \frac{SS_{TR}}{t - 1} = 9173.61/14 = 655.26$$

$$SS_E = \Sigma SS_i \text{ (in table 2)} = 117604.77$$

$$MS_E = SS_E / \sum_{i=1}^{t} (n_i - 1) = 117604.77/316 = 372.17$$

$$F = MS_{TR}/MS_E = 655.26/372.17 = 1.76^{**}$$

From tables, $F_{(.05,14,316)} = 1.70$

Since 1.76 1.70, reject the null hypothesis. Hence at least one pair not equal. We need to know which μ_i is significantly less than that of the experimental group. For this we will use the Dunnet's test.

** For further explanations see Pfaffenberger p.378

DUNNETT'S TEST (Zar p.157)

In Dunnett's test we use ranked means. From table I we have:

52.22, 59.0, 61.83, 62.56, 65.04, 66.21, 66.27, 66.44, 67.46, 67.88
71.00, 71.34, 71.88, 73.76, 74.71

where $\mu_6 = 66.21$ is the mean of the experimental class. Since we want to know how many classes did worse than the experimental class, we will consider only the first six ranked classes and try to determine whether and which of them did significantly worse than the experimental class. This test makes use of "q", the "Studentized ranges" and the calculated "q" is compared with a tabulated value.

$$q = (\bar{X}_B - \bar{X}_A)/SE$$

where SE = standard error = $(s^2(1/n_A + 1/n_B))^{\frac{1}{2}}$

In the table below "p" is the number of means in the range of means being tested; i.e. μ_5 & μ_1 gives p = 5

H_o: $\mu_6 = \mu_A$

Comparison	Difference	SE	q cal.	p	q tab.	Conclusion
6 v. 1	13.99	6.02	2.32	6	2.23	Reject H_o
6 v. 2	7.21	5.84	1.23	5	2.16	Accept H_o
6 v. 3	4.38	5.63	.78	4	2.06	Accept H_o
6 v. 4	3.65	5.41	.67	3	1.92	Accept H_o
6 v. 5	1.17	5.57	.21	2	1.64	Accept H_o

Thus we see that only one mean, the u_1 is significantly different from u_6. To check our result we will use the t-test next.

THE T-TEST

Since this test requires that the standard deviations of the polulations from which the samples were obtained are equal, we will use the F-test, $F = s_A^2/s_B^2$, to test $H_o: \sigma_A^2 = \sigma_B^2$

If H_o is accepted, we will find $t = (\bar{x}_A - \bar{x}_B)/ \sigma_p(1/n_A + 1/n_B)^{\frac{1}{2}}$

where $\sigma_p = ((n_A s_A^2 + n_B s_B^2)/(n_A + n_B - 2))^{\frac{1}{2}}$; or, if H_o is rejected,

from $t = (\bar{x}_A - \bar{x}_B)/(s_A^2/n_A + s_B^2/n_B)^{\frac{1}{2}}$; $H_o: \mu_A = \mu_B$ for both "t". For results see table below.

k_i	n_i	$\bar{x}_i$	s_i	$F_{(cal.)}$	$F_{(tab.)}$	H_o	$t_{(cal.)}$	$t_{(tab.)}$	Conclus.
1	24	66.21	13.86	--- Experimental class					
2	18	52.22	19.22	1.92	2.10	Accp.	2.67	1.96	$\mu_1 = \mu_2$
3	20	59.00	14.50	1.09	2.05	Accp.	1.64	1.96	$\mu_1 = \mu_3$
4	24	65.04	22.77	2.70	2.02	Rejc.	.22	1.96	$\mu_1 = \mu_4$
5	27	62.56	21.25	2.35	1.99	Rejc.	.73	1.96	$\mu_1 = \mu_5$
6	23	61.83	24.54	3.13	2.03	Rejc.	.75	1.96	$\mu_1 = \mu_6$
7	25	73.76	17.99	1.68	2.01	Accp.	1.61	1.96	$\mu_1 = \mu_7$
8	17	71.88	18.62	1.80	2.08	Accp.	1.09	1.96	$\mu_1 = \mu_8$
9	7	74.71	26.72	3.72	2.53	Rejc.	.81	1.96	$\mu_1 = \mu_9$
10	29	71.34	19.43	1.97	1.98	Accp.	1.06	1.96	$\mu_1 = \mu_{10}$
11	30	66.27	17.88	1.66	1.97	Accp.	.01	1.96	$\mu_1 = \mu_{11}$
12	16	66.44	18.88	1.86	2.30	Accp.	.04	1.96	$\mu_1 = \mu_{12}$
13	26	67.46	18.95	1.87	2.00	Accp.	.26	1.96	$\mu_1 = \mu_{13}$
14	26	67.88	17.66	1.62	2.00	Accp.	.36	1.96	$\mu_1 = \mu_{14}$
15	19	71.00	18.91	1.86	2.06	Accp.	.94	1.96	$\mu_1 = \mu_{15}$

This agrees with the first analysis and also shows us that there there are no classes with means significantly greater than μ-experimental.

PART II

INSTRUCTIONS FOR THE MANAGER

The manager of the IDS System has duties as follows:

1) To remove "John Doe's" and obscenities from the student file.

2) To printout and file two rosters after step (1) has been completed.

3) Check the status of the student file and either
   a) increase its size if usage is over 80%,
   b) decrease its size if the space is required elsewhere and usage is below 50%,
   c) leave its size the same.

4) To printout and file two comment listings.

5) Check the status of the comment file and either
   a) increase its size if usage is over 80%,
   b) decrease its size if the space is required elsewhere (such as the student file, which has priority over the comment file) or usage is below 50%.

6) To give any teacher the record of his or her student by the former's request only.

These duties must be carried out twice monthly, on the second and fourth Fridays of each month. At the end of the semester, the student and comment files are to be deleted.

USING THE JAC RABBIT 2000 COMPUTER

You must always remember to press the button marked 'return' after entering a line of data.

Here is a list of the commands you need to know:

HELLO - M2ØØ,password,terminal type [RETURN] This command signs you on to the computer.

GET - program name [RETURN] This will retrieve a program that is stored in the computer and enter it into your work space, or the "scratch pad area".

RUN [RETURN] This executes the program currently stored in your work space.

BYE [RETURN] This command signs you off at the computer.

It is suggested that the IDS System manager read the chapters in the HP 2000 ACCESS user's manual pertaining to system structure and the pages referring to the above commands.

Obtaining a Roster

A roster is a complete listing of all the students who have used, or are using the IDSS facilities. Data on each student include name, student I.D. number, the date and time that student last used the System, the total amount of time the student has spent on the System, how many times he has used it, and the number of questions they have completed in each specific category.

It may be noted here that the System manager should also be familiar with using the IDSS programs, i.e., that he be able to use "DIALOG". If you (the System manager) have not already done so, it is suggested that you read the "IDSS USER'S MANUAL" and become familiar with the calculus programs.

To obtain a roster, enter:

GET-ROSTER [RETURN]
RUN [RETURN]

The program will type:

Sort by:
1. Student I.D.
2. Amount of time used
3. Number of times used
4. Date last used

?

At the question mark, type the number corresponding to the type of sort you desire, and press 'RETURN'. The program will respond with:

Set top of form, then press 'RETURN'

You must adjust the paper so that the seration is above the print head.

Changing the Student File

This section will deal with changing student information that is already on file. There are two programs that alter the student file; "IDSFMP" and "MANAGE". We will discuss the latter, and leave the other for another section of this manual.

The program "MANAGE" has the following functions:

1) Updating student information.
2) Deleting a student or a single item.
3) Listing the contents of the student file.

To use "MANAGE", enter:

GET-MANAGE [RETURN]
RUN [RETURN]

The program will respond with:
Update, delete, list, or stop (enter a 1, 2, 3, or 4)- - >
and wait for you to enter a 1, 2, 3, or 4, depending on what you wish to do.

When updating or deleting items, the item numbers MUST BE KNOWN. Using the list option (option 3), the program will printout the items compared by their item numbers on the left.

The data in the file is in the following order:

Student numerical information (I.D., time on, etc.)
Student's name
Student's teacher's name.

Here is a sample listing:

```
4   7647021001000213541403287020l AAAAAAAAAA
5   Elmo Fnertinizer
6   George Breznak
7   765617500460331115111832002O1 HCB AAAAAAA
8   Sonja Bjernhold
9   Bob DeJacques
```

Items 4 and 7 are student numerical information, items 5 and 8 are students' names, and items 6 and 9 are teachers' names.

WHEN UPDATING a student numerical info. string, MAKE SURE that you change ONLY what you had intended to. Also, make sure that the string is the correct length.

WHEN DELETING a student, MAKE SURE that you identify him/her by the item number at the left of their Student Numerical Information.

Note: Pressing the 'Break' key during a listing will NOT cause the program to terminate. Instead, the listing will interrupt and the program will request a command.

Changing File Sizes

This section applies to the student comment file, as well as the file containing the student information.

Upon running the program (it's called "IDSFPM") it will give you the status of the two files. Example

GET - IDSFPM [RETURN]
RUN [RETURN]

The student informa tion file is currently 55 records long. This file is filled to 46% of its possible capacity.

The comment file is currently 10 records long. This file is filled to 86% of its possible capacity.

You may:

1. Change the student file storage capacity.
2. Erase the student records on file.
3. Change the comment file storage capacity.
4. Erase the comments on file.
5. Stop the program

Enter your option - - >

As you can see, this program is fairly straightforward to use.

Obtaining a Listing of Comments

The program you must use for this is called "COMLIS".

Enter:

GET-COMLIS [RETURN]
RUN [RETURN]

The program will respond with:

SET TOP OF FORM, THEN PRESS 'RETURN' .

Set the paper so that the serration is just above the print head, then press return. The program will give the date listed, and then list the comments. The comments will be in the form of:

Student I.D. Date and time comment made
Student name
Comment
(1 line is skipped here.)

Problem Sets

Of course, being familiar with the IDSS system you are aware that students are able to receive problems to work on from the computer. You, of course, have to enter them.

The program to use is called "IDSSPM". When you "GET" and "RUN" the program, it will simply type:

COMMAND - - >

The commands are as follows:

0	List the command set
1	List problem headings
2	List a problem set
3	List the entire file
4	Update an item
5	Update a heading
6	Append an item
7	Append a heading
8	Erase a problem set and its heading

Pressing the 'RETURN' button without typing a number will cause the program to end.

On the following page is a sample running.

```
get-idsspm
run
IDSSPM


Command-->0
   1       List problem headings
   2       List a problem set
   3       List the entire file
   4       Update an item
   5       Update a heading
   6       Append an item
   7       Append a heading
   8       Erase a problem set and its heading


Command-->1

  SET
  NO.     REC         HEADING

   1.      6      Power Rule (Level I)
   2.      8      Power Rule (Level II)
   3.      9      Chain Rule (Level I)
   4.     13      Product Rule (Level I)


Command-->2
SET NUMBER-- 3


LISTING OF PROBLEM SET '3'

BLOCK 1 IN RECORD 9

PROB.
  NO.    ITEM     INDEPENDENT VARIABLE, PROBLEM, AND ANSWER

   1.      1      x
                  3(x-1)^2
                  6(x-1)  (1+0)

   2.      2      x
                  3(x^2-2x-3)^(-3/4)
                  (-9/4)(x^2-2x-3)^(-7/4)(2x-2+0)
```

In the listing, the ITEM number refers to the item number in that particular record. When updating an item, you must refer to the RECORD number that it is within, and to its item number.

When replying to all verifications in this program, type "YES" for positive verification. Anything else you enter will be regarded as a negative answer.

There is no verification required when deleting a heading and its problems.

There is a maximum of 40 headings that can be used in this system.

Suspending System Operation

This is referring to the Calculus System only.

When changing a file, it is best that the system be "closed" so as to prevent file damage and read/write failure on either the part of the user or the manager.

To "close" the system, simply type:

EXE-CLOSE [RETURN]

This will initiate a sequence which will "close" the calculus system.

If you wish, when the program types:

MESSAGE:

you may enter a message up to as many lines as it takes. Pressing the 'RETURN' button without entering anything else on the line will end the program.

To reopen the System, type

EXE-OPEN [RETURN]

This also erases the message you may have entered.

PART III

DATA FOR THE PROGRAMMER

VARIABLE ASSIGNMENT

General: One character variables are permanent.
Variables such as TØ, IØ, are the most temporary.
Variables T1 - T9, Z1 - Z9, etc. are general storage.

A = Answer to question
B = Brackets
C = Counters
D = Data
E =
F = Flags
G = General Purpose Variables
H =
I = Loops
J = Loops
K =
L = Length (of string, substring)
M =
N = NUM function value
O =
P = POS function value
Q =
R = Return Variable
S = Subroutine Variable
T = Temporary Variables
U =
V =
W = Working Variables
X = String or Matrix Subscripts
Y =
Z = Tracer Variables

STRING ASSIGNMENT

A$	=	ANSWER TO QUESTION STRING
B$	=	
C$	=	COM STRING
D$	=	READ DATA STRING
E$	=	
F$	=	
G$	=	GENERAL PURPOSE STRING
H$	=	
I$	=	INPUTTED FUNCTION STRING
J$	=	
K$	=	
L$	=	
M$	=	
N$	=	
O$	=	OUTPUT DERIVATIVE STRING
P$	=	
Q$	=	
R$	=	RETURN STRING
S$	=	SUBROUTINE STRING
T$	=	TEMPORARY STRING
U$	=	
V$	=	
W$	=	WORKING STRING
X$	=	
Y$	=	
Z$	=	TRACER STRING

C$, CØ$, and C1$ are COM strings, meaning that they are used for communications between programs. As such, they are in the Common block at the beginning of each program. If a string in one program is to be saved for use in another program, use C$, or CO$, or C1$ to save it. Only use this technique for communicating between programs for the same derivative function.

For example, IDSSØ3, IDSAØ3, IDSDØ3, and IDSD13 form one block - all have to do with the QUO/PROD function.

Likewise, IDSSØ2, IDSDØ2, and IDSD12 are another such block.

Class A/B Explanation

There are two classes of differentiating programs. A Class A program is one which requires another program to behave as a subroutine in that control must return to the Class A program. A good example of this is IDSSØ3. This program must have each term differentiated by the appropriate programs and then must have these programs return to IDSSØ3 so it can place them in the proper place in the output string. A Class B program, on the other hand, is one which can do its part in one shot. IDSSØ4 is a good example of a Class B program. To differentiate sin(x), for example, it places "-cos(" in the output string and replaces the ")" in the input string with a ">" . IDSSØZ will finish off the job by placing "1" if X is the independent variable, or "X' " if X is a dependent variable into the output string and next remove "X" from input string. Then, seeing a ">" as the next character in the input string it will place a ")" in the output string. Notice that no return to IDSSØ4 was necessary. This distinguishes Class B programs from Class A programs.

SYSTEM FLOW

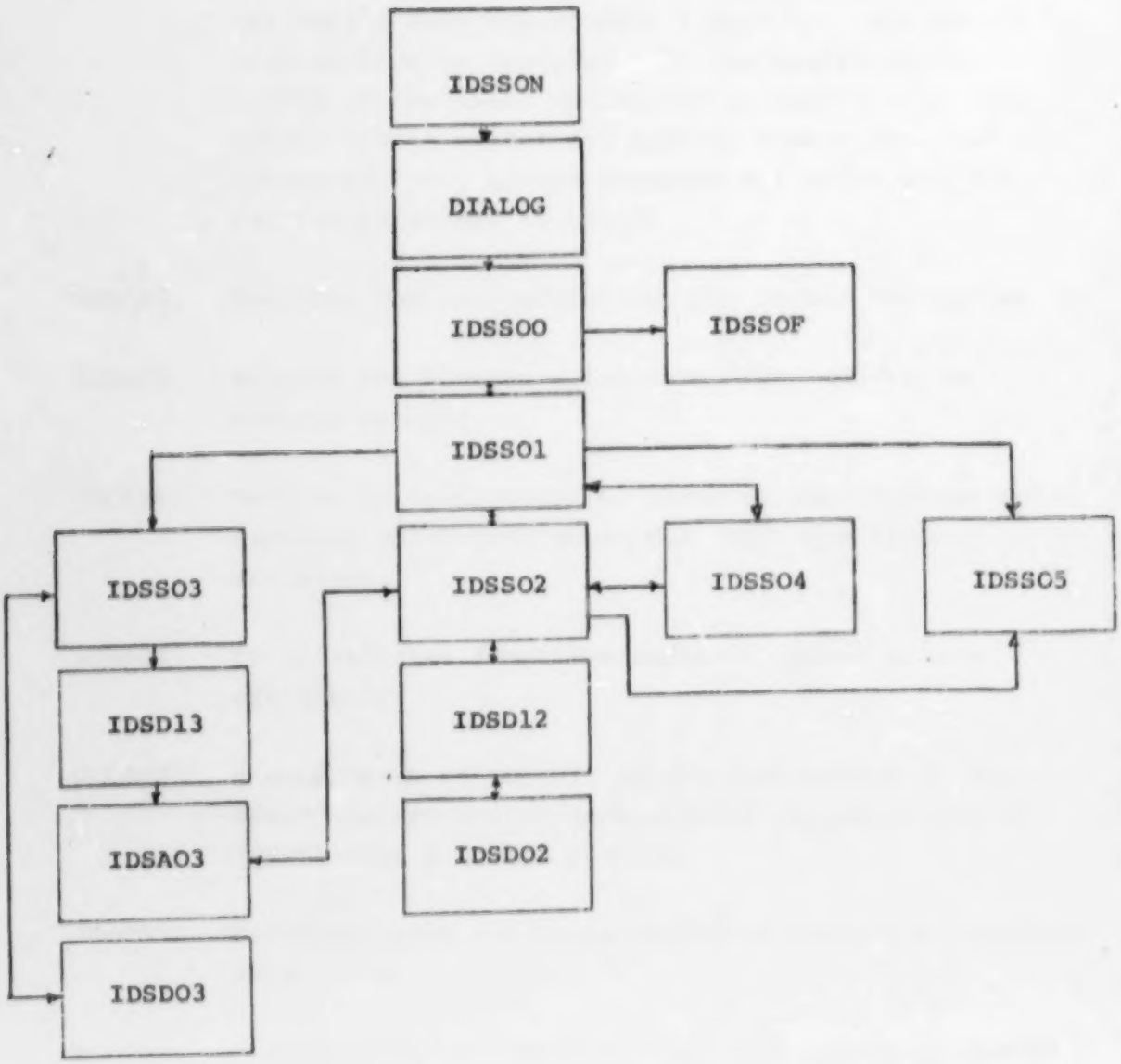


FIGURE I

PROGRAM OUTLINES

IDSSON: Acts as the signon program. This program requests the user's name and student I.D. code. The user's sign on time is recorded. If the system has no record of the user, the user's teacher's name, the user's course number and section number are also requested. Any system messages are given and then control is passed to DIALOG.

DIALOG: Contains the instructions on how to use the system.

IDSSOO: Accepts the student's function, then checks for various errors.

IDSSO1: Acts as an interpreter by checking the function and deciding which program should start the differentiation.

IDSSO2: Differentiates functions requiring power rule or chain rule.

DLOGO2: A subprogram of IDSSO2. Space limitations of the HP2000 Access system necessitated the splitting of IDSSO2 into a second program.

IDSSO3: Differentiates functions requiring product or quotient rule.

DLOGO3: A subprogram of IDSSO3 for the same reason as DLOGO2.

IDSSO4: Differentiates the six basic trigonometric functions.

IDSSOF: Signs off the student while recording the log-off time, accumulated time and displaying current session time.

IDSSØ1 General Description

This program must interpret the function contained in W1$ and decide which program should start the differentiation.

The first step is to check whether there is anything left to be differentiated. If not, then control is returned to IDSSØØ. Otherwise, IDSSØ1 will search for the first zero element in Q and set this to a default of 2 for IDSSØ2. W1$ is set to W$. Now, interpretation begins. Any sign (plus or minus) is removed.

IDSSØ2/DLOGØ2 - GENERAL PROGRAM DESCRIPTION

Initially IDSSØ2 and DLOGØ2 were one program under the name IDSSØ2. However, as the length of IDSSØ2 grew, it was necessary to break IDSSØ2 into two programs. Since the new program contained most of the conversational dialog and was part of IDSSØ2, the name DLOGØ2 was chosen, DLOG being an abbreviation of "DIALOG".

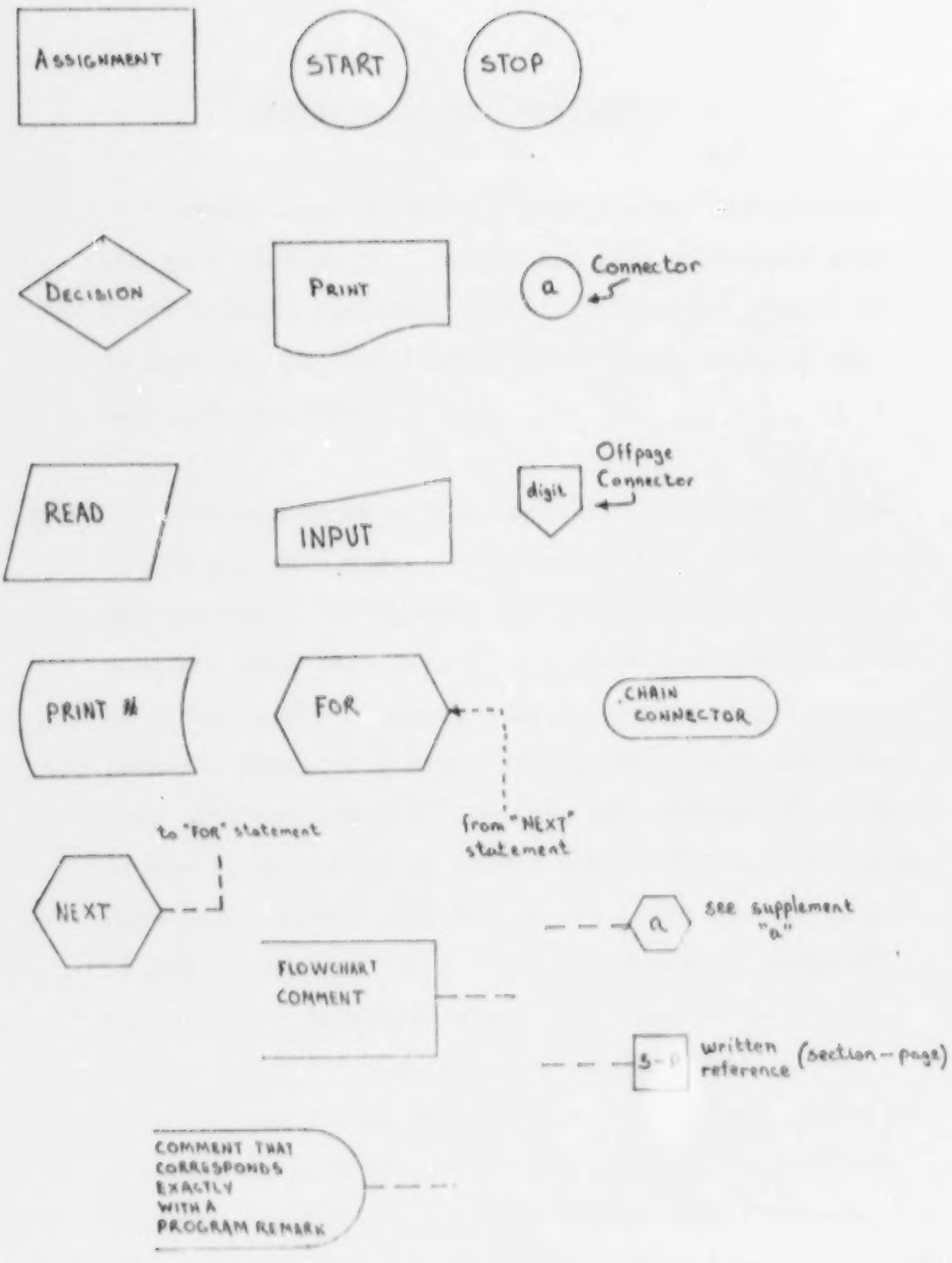
First, IDSSØ2 finds the coefficient and exponent of the piece to be differentiated and stores these in M[2] and M[4] respectively. M[3] is set to zero if the piece being differentiated requires the chain rule. If, instead, the program is differentiating a variable, then M[3] = NUM(variable). For example, if the variable is upper case X, then M[3] = NUM("X"), which is 88.

If the program is dealing with a chain, then M[6] and M[7] equal the subscripts referencing the location of the "(" and ")", respectively, in W1$ that surround the chain. For example, if W1$ = "(x^3-3x)^(-⅔)", then M[6] = 1 and M[7]=8. If the program is dealing with a variable, then M[6] and M[7] are not used.

M[1] and M[5] are not used in this system and are for future modifications.

Once the 'M' matrix is set up, DLOGØ2 is chained to. DLOGØ2 sets up D1$, the derivative, step by step in a conversational mode with the student. Then control is returned to IDSSØ2. Then, W1$ is shortened by removing the piece that was just differentiated. Then, the whole process is repeated until either W1$ has been reduced to a length of zero or the program encounters something it cannot recognize. In the former case, control is transferred to the "STORE THE DERIVATIVE" section. In the latter case, control transfers to IDSSØ1, the interpreter.

Flowchart Symbol Assignment



IDSS02 FLOWCHART REFERENCES

I2.1 When a term or differentiable unit (program-wise, not in a mathematical sense) has been differentiated, it is removed from W1$. So, if W1$ is now empty, it is because all that IDSS02 was to differentiate has been differentiated.

I2.2 A close check will reveal that the flowchart decision box does not agree with the program statement. The flowchart box is correct. The computer statement, however, says that even if the first character in W1$ is a ">", try converting again. Now, clearly a ">" is not a digit or a sign or a decimal point and therefore will not convert. So, why the statement? Well, if the first character in W1$ was a ">", the ">" would have been removed from W1$ in the third previous box of the flowchart. So in fact the computer statement is partially redundant since it checks for a first character of ">" when in fact this case cannot be. This redundancy was kept because it allowed the use of a single compact statement at a time when IDSS02 was close to the 10K word program limit. The flowchart does not include the redundant check so that the intent

could be seen as opposed to the implementation.

I2.3 The statement to be explained is:

L2=L1*(B1=0)+B1+2

There are two possible values for this statement. If no opening parenthesis was found, then the ". . . FINDING THE MATCHING CLOSE PARENTHESIS" section will be bypassed leaving B1=0. So our statement simplifies as follows:

```
L2=L1*(B1=0)+B1+2          but B1=0
 =L1*1+0+2
 =L1+2
```

Since L1 is the subscript referencing the character after the coefficient and we know there is no chain rule involved (remember that no "(" was found), L1 must reference a variable. Therefore L1+2 will reference the exponent if there is one (eg. x^2 so if L1 references x, L1+2 references the exponent). On the other hand, if the program found an open parenthesis, then the ". . . FINDING THE MATCHING CLOSE PARENTHESIS" section would have been executed. This means B1 will not be zero, so our statement simplifies as follows:

```
L2=L1*(B1=0)+B1+2          (B1 not zero)
 =L1*0+B1+2
 =B1+2
```

Since B1 is the subscript referencing the matching close parenthesis in W1$, B1+2 will reference the first character in the exponent, if there is one.

I2.4 Actually, W1$ is not truncated because a truncation is the removal of characters from the right whereas W1$ has characters removed from the left. However, the term "truncation" was used anyway.

If the term just differentiated required only the power rule, then that term is simply removed from W1$. For example, if W1$="3x^2-6x" then when 3x^2 has been differentiated, W1$ will become "-6x". If the term just differentiated required the chain rule, then things are a little more complex. In using the chain rule on "6(x^2-3)^-2", the 6(. . .)^-2 is differentiated and then whatever was contained within the parentheses (which is "x^2-3" in this case) is differentiated. Consequently, IDSS02 will remove the "6(" and the "^2" from W1$ and replace the ")" with a ">" leaving what was inside to be differentiated. The reason for the ">" is that the output format for the derivative of "6(x^2-3)^-2" is "-12(x^2-3)^-3 (2 x+0)". To do this, DLOG02 places "-12" into D1$ followed by "(x^2-3)" followed by "^-3 (". Then the "6(" and the "^-2" is removed from W1$ and IDSS02 differentiates "x^2-3>". DLOG02 puts "2x+0" in D1$ so that we have "-12(x^2-3)^-3 (2x+0". The next thing in W1$ is ">" because "x^2" and "-3" have been removed by now from W1$. This ">" signifies that a closing parenthesis must be put into D1$. To summarize pictorially:

	W1$	D1$
STEP 1	"6(x^2-3)^-2"	""
STEP 2	"x^2-3>"	"-12(x^2-3)^-3 ("
STEP 3	"-3>"	"-12(x^2-3)^-3 (2x"
STEP 4	">"	"-12(x^2-3)^-3 (2x+0"
STEP 5	""	"-12(x^2-3)^-3 (2x+0)"

I2.5 The whole section on page five of the IDSS02 flowchart is responsible for converting a fractional exponent into M[4]. To do this, the numerator is converted to U[1] (the matrix U was set up specifically for this purpose). Then the "/" separating the numerator from the denominator is removed and the conversion of the denominator into U[2] takes place. Finally, M[4] is set to U[1]/U[2].

I2.6 This section also applies when O$ and O1$ are substituted for D$ and D1$ respectively.

If D$ is empty or if the last character in D$ is a "(", then placing a "+" sign in D$ before placing D1$ in D$ is redundant because algebraic rules dictate that a "+" would be assumed anyway. For example, ". . . (3x+2)" not ". . . ("3x+2)" and "3x+7(. . . " not "+3x+7(. . . ".

IDSSO4

GENERAL PROGRAM DESCRIPTION

This program differentiates any of the six basic trigonometric functions which are:

sine	cosecant
cosine	secant
tangent	cotangent

The program receives W$ with the trig function starting at the first position in the string. It then sets W1$ and G1$ equal to W$ for the following reasons:

1. W1$ is used as a working string, so W$ can be referenced at any time throughout the program. W$ is set at the end of the program to "u>[rest of inputed function]", where u is the argument of the trig function, and
2. G1$ is used near the end of the program in some formatted output.

The sign, coefficient, and type of function are then determined by the program and the sign is then appended to DØ$, depending on the function type. The coefficient is then appended, and then the trig derivative also. For example, if we are differentiating "cos(u)", then DØ$ becomes "-sin(u)(". (Remember: the u' must follow the derivative of the trig function).

W1$ is then set to "u [rest of function]". (See "General System Description" page 12 for reference concerning the ">".) W$ is fractionalized, and DØ$ is appended to O$ before the program finally chains back to IDSSØ1.

STUDENT FILE ORGANIZATION - FILENAME: STUDNT

Information String - 69 CHARS LONG

[01,Ø7] = STUDENT ID CODE (ddddddd)
[Ø8,11] = TOTAL TIME (dddd)
[12,14] = TOTAL NUMBER OF TIMES USED (ddd)
[15,18] = LAST TIME USED - LOG IN TIME (dddd)
[19,22] = LAST TIME USED - LOG OUT TIME (dddd)
[23,25] = LAST TIME USED - JULIAN DATE (ddd)
[26,27] = COURSE NUMBER (according to IDSSON code)
[28,29] = SECTION NUMBER
[3Ø,69] = PROBLEM STATUS (A TO Z) ALPHA INFORMATION

In problem status, an 'A' indicates that the student has done problem (A-ascii(1)) in that particular category i.e., he has not done one yet. The problem status supplies which problem in a specific category to choose. It is incremented each time the student receives a new problem.

Alphabetics were chosen over numbers, as up to 26 problems can be used in each category.

STUDENT NAME STRING - allowed up to 132 characters long, but only 20 will print out in any given report. The names are set to lower case and then first characters of each name are capitalized in IDSSON.

STUDENT'S TEACHER'S NAME STRING - same specifications as student name string.

Information in STUDNT is packed as follows:

I	N	T	I	N	T	I	N	T	I	N	T	I	N	T	I	N	T	I	N	T	etc.

IDSSON identifies the strings as I$ → information
N$ → name
T$ → teacher's name

Variable listing of variables assigned in ID3D13

DATE TABLE PRODUCED: 11:10 APRIL 8 1978
DATE LAST MODIFIED: 7708.16 12.25

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	000	...	...	...	...	...	...	...	...	000	000	...	...
B	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	...	...	...	...	...	...	...	...	...	...	000	...	000
E	...	...	...	...	...	...	...	...	...	...	...	000	...	000
F	000	...	...	...	...	...	...	...	...	...	...	...	000	000
G	...	...	...	...	...	...	...	...	...	...	...	000	000	000
H	...	...	...	...	...	...	...	...	...	...	...	...	000	000
I	000	...	...	...	...	...	...	...	000	000	...	000	...	...
J	...	...	...	...	...	...	...	...	...	...	...	...	...	...
K	...	...	...	...	...	...	...	...	...	...	...	...	...	...
L	000	...	000	000	000	000	...	...	...	...	...	...	...	...
M	...	...	...	...	...	...	...	...	...	...	000	...	...	...
N	...	...	...	...	...	...	...	...	...	...	...	000	...	...
O	...	...	...	...	...	...	...	...	...	...	...	000	...	...
P	...	000	...	...	...	...	...	...	...	...	...	...	...	...
Q	...	...	...	...	...	...	...	...	...	...	000	000	...	...
R	000	000	000	000	...	...	...	...	...	...	...	...	...	...
S	...	...	...	...	...	...	...	...	...	...	...	...	000	...
T	000	...	...	...	...	...	...	...	...	...	...	...	...	...
U	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W	000	...	...	...	...	...	...	...	...	...	...	000	...	000
X	...	...	...	...	...	...	...	...	...	...	000	...	...	...
Y	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Z	...	...	...	...	...	...	...	...	...	...	000	...	...	...

F	:	1						
I	:	9120	9610					
L	:	1						
R	:	1						
T	:	1005						
W	:	1						
A3	:	2460						
P3	:	2130	9930					
R3	:	9620						
L1	:	1						
R1	:	1	1110	1120	1220	1230	1340	9720	9740
L2	:	1						
R2	:	1120	1230	1340	2030	2460		
L3	:	1						
L4	:	1						
I8	:	1980						
I9	:	1960						
A[]	:	1						
M[]	:	1						
Q[]	:	1						
X[]	:	1						
Z[]	:	1						

```
A$    :  1010  1430  2110  2120  2150  2210  2220  2290  2300
         2660  2770  9130  9920  9950
C$    :     2
D$    :     2
E$    :     2
G$    :  1010
I$    :     3
N$    :     3
O$    .     3
Q$    :     3
W$    :     3
C0$   :     2
F0$   :  1010  1990
G0$   :  1010  9410  9420  9560  9570  9580  9590  9600  9780
         9800
H0$   :  1010  1990
S0$   :  1010  1990
C1$   :     2
D1$   :     2
E1$   :     2
F1$   :  1010  1990
G1$   :  2030  2045
H1$   :  1010  1990
W1$   :     3

NUMBER OF VARIABLES USED = 44
NUMBER OF ASSIGNMENT STATEMENTS = 85
```

Variable listing of variables assigned in ID3A03

DATE TABLE PRODUCED: 11:13 APRIL 8 1978
DATE LAST MODIFIED: 7804.05 21:38

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	...	...	...	...	...	...	000	000	...	...
B	...	000	...	...	...	...	...	...	...	...	...	...	...	...	...
C	...	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	000	...	000	...	...	...	...	...	...	...	...	000	000	000
E	...	...	...	...	...	...	...	...	...	...	...	..	000	...	000
F	000	...	000	000	...	...	...	...	...	...	...	...	000	...	...
G	...	...	...	...	...	...	...	...	...	...	...	...	000	000	...
H	...	...	...	...	...	...	...	...	...	...	...	...	000	...	...
I	000	000	...	...	...	..	..	...	...	...	...	...	000	...	...
J	000	...	...	...	...	...	...	...	...	...	...	...	...	...	..
K	..	...	...	...	...	...	...	...	...	...	..	...	...	...	...
L	000	...	000	000	000	000	...	...	...	...	...	...	..	...	...
M	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...
N	...	000	..	...	...	...	...	...	...	...	...	...	000	000	...
O	...	...	...	000	...	...	...	...	...	...	...	...	000	..	...
P	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...
Q	...	...	...	...	...	...	..	...	...	...	...	000	000	...	..
R	000	000	000	...	...	...	...	...	...	...	...	...	...	000	000
S	...	000	...	...	...	...	..	...	...	...	...	..	..	000	...
T	...	000	...	...	...	...	...	...	...	...	..	000	...	...	...
U	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...
V	...	...	...	...	...	...	...	...	...	...	..	..	...	...	...
W	000	...	...	...	...	...	...	...	...	...	...	...	000	...	000
X	...	...	000	000	000	000	..	...	...	...	...	000	...	...	...
Y	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Z	...	...	...	...	...	...	...	..	...	..	...	000	...	...	...

F	:	1							
I	:	1170	1360	1460	1620	2480	2770	3130	3350	3380
		3510	3660	3730	3870	8400	9330			
J	:	3890								
L	:	1								
R	:	1	140							
W	:	1								
B0	:	3480	3530	8380	8420					
D0	:	3930								
I0	:	8190	8610							
N0	:	2090	3390	3520	4020	8410				
R0	:	8050	9340							
S0	:	1940	2380	2620	2640					
T0	:	8040								
F1	:	1540	1550							
L1	:	1								
R1	:	1	9440	9460						
X1	:	1420								
D2	:	2030								
F2	:	1210								
L2	:	1								
O2	:	4010								

```
X2    :  1490
L3    :     1
X3    :  1550
L4    :     1
X4    :  1650
A[]   :     1
M[]   :     1
Q[]   :     1 ·  1220   3820
T[]   :  1060   1160   1820
X[]   :     1   2270   3670
Z[]         1
A$    :   120   1060
C$    :     2
D$    :     2   2110   2130   2140   2280   2500   2510   2520   2750
         2760   2780   2790   3120   3160   3170   3190   3210
E$    :     2
F$    :  1060   1760
G$    :  1060
H$    :  1070
I$    :     3
N$    :     3
O$    :     3   4040   4050
Q$    :     3   1710
W$    :     3   2150   2920   3320   3430   8520   3530
C0$   :     2
D0$   :  1060
G0$   :  1060   1750   9230   9240   9280   9290   9300   9310   9320
         9500   9520
N0$   :  1070
R0$   :  1070   8060   8080   8090   8140   8240   8280   8620
S0$   :  1070   1950   2650   8100   8150
C1$   :     2
D1$         2
E1$   :     2   1700
R1$   :  1070   8060   8110   8160
W1$   :     3

NUMBER OF VARIABLES USED = 55
NUMBER OF ASSIGNMENT STATEMENTS = 143
```

Variable listing of variables assigned in IDSD02

DATE TABLE PRODUCED: 11:16 APRIL 8 1978
DATE LAST MODIFIED: 7703.11 11:21

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	...	...	...	...	...	000	000	...	...
B	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	000	...	...	...	...	...	...	...	...	...	000	...	000
E	...	...	...	...	...	...	...	...	...	...	...	000	...	000
F	000	000	000	000	000	000	...	...	...	...	...	...	...	...
G	000	...	...	...	...	...	...	...	...	...	...	000	000	000
H	...	...	...	...	...	...	...	...	...	...	...	000	...	...
I	000	000	...	...	...	...	...	...	...	...	...	000	...	...
J	...	...	...	...	...	...	...	...	...	...	...	...	...	...
K	...	...	...	...	...	...	...	...	...	...	...	...	...	000
L	000	...	000	000	000	000	...	...	...	...	...	...	...	...
M	...	...	...	...	...	...	...	...	...	...	000	...	...	...
N	...	000	...	...	...	...	...	...	...	...	...	000	...	...
O	...	...	...	...	...	...	...	...	...	...	...	000	...	...
P	...	000	...	...	...	...	...	...	...	...	...	...	...	...
Q	...	...	...	...	...	...	...	...	...	...	000	000	...	...
R	000	000	000	...	...	...	...	...	...	...	...	...	...	...
S	...	...	...	...	...	...	...	...	...	...	...	...	...	...
T	...	...	...	...	...	...	...	...	...	...	...	...	000	...
U	...	...	...	...	...	...	...	...	...	...	000	...	...	...
V	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W	000	...	...	...	...	...	...	...	...	...	...	000	...	000
X	...	...	000	000	000	...	...	...	...	...	000	...	...	...
Y	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Z	...	...	...	...	...	...	...	...	...	...	000	...	...	...

F :	1		
G :	1560	2500	3610
I :	9420		
L :	1		
R :	1		
W :	1		
D0 :	8150		
F0 :	8120		
I0 :	8110		
N0 :	1490	8100	8140
P0 :	4050		
R0 :	190	9430	
F1 :	1420	2470	3590
L1 :	1		
R1 :	1	9530	9550
X1 :	1380		
F2 :	1430		
L2 :	1		
X2 :	2480	3570	
F3 :	2710		
L3 :	1		
X3 :	4060		

```
F4    :  2720
L4    :     1                          50
A()   :     1
M()   :     1  2810  3780
Q()   :     1
U()   :  1020
X()   :     1
Z()   :     1
A$    :   170  1020
C$    :     2
D$    :     2
E$    :     2
G$    :  1020
H$    :  1020
I$    :     3
N$    :     3
O$    :     3
Q$    :     3
W$    :     3
C0$   :     2
G0$   :  1020  9220  9230  9370  9380  9390  9400  9410  9590
         9610
T0$   :  1030
C1$   :     2
D1$   :     2  1540  2130  2490  2610  3310  3600  4000  4010
         8180  8190  8200  8210  8230  8250
E1$   :     2
G1$   :  1020  1210  1230
K1$   :  1020  1250  1460  1630
W1$   :     3

NUMBER OF VARIABLES USED = 50
NUMBER OF ASSIGNMENT STATEMENTS = 91
```

Variable listing of variables assigned in IDSD03

DATE TABLE PRODUCED: 11:19 APRIL 8, 1978
DATE LAST MODIFIED: 7804.08 09:30

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	...	..	...	...	...	...	000	000	...	...
B	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C	...	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	...	...	...	...	...	...	...	...	...	...	...	000	000	000
E	...	...	...	...	...	...	...	...	...	...	...	...	000	...	000
F	000	000	000	000	...	...	...	...	...	...	..	...	. .	...	...
G	...	...	...	...	. .	...	...	...	...	...	...	. .	000	000	000
H	...	...	...	...	...	...	...	...	...	...	...	...	000	...	. .
I	000	000	...	...	...	...	...	. .	...	...	...	...	000	...	...
J	000	...	...	...	...	...	...	...	...	...	...	..	...	...	..
K	...	...	...	...	...	...	...	. .	...	...	...	..	...	...	...
L	000	000	000	000	000	000	...	...	...	...	...	...	..	...	...
M	...	...	...	...	...	...	...	...	...	...	...	000	...	...	..
N	...	...	...	...	...	...	...	...	...	...	...	...	000	000	...
O	...	...	...	...	...	...	...	...	...	...	...	...	000	...	...
P	...	...	000	000	...	...	...	...	...	...	..	..	...	. .	...
Q	...	...	...	...	...	...	...	...	...	...	...	000	000	...	...
R	000	000	000	...	...	...	...	...	...	...	...	...	...	000	000
S	...	000	...	...	...	...	...	...	...	...	...	...	...	000	...
T	...	000	000	000	000	000	000	...	...	...	...	000	...	...	...
U	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V	...	...	...	...	...	. .	...	...	...	..	...	...	...	. .	. .
W	000	...	...	...	...	...	...	...	...	...	...	...	000	...	000
X	...	...	000	000	000	000	...	...	...	...	. .	000	...	...	...
Y	...	...	...	...	...	...	...	...	...	...	...	...	. .	...	...
Z	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...

F	:	1							
I	:	1210	1280	1350	1430	1530	1940	2180	2560	2870
		2990	3490	3650	4380	4480	4600	4870	9340	
J	:	1950	3500	4390						
L	:	1								
R	:	1	140							
W	:	1								
F0	:	2210	2310	2520						
I0	:	8190								
L0	:	2240								
R0	:	8050	9350							
S0	:	2800	3130	3170	3250					
T0	:	1660	4300	8040						
F1	:	1420	1460							
L1	:	1								
P1	:	2190	2250							
R1	:	1	9450	9470						
T1	:	3790								
X1	:	1310								
F2	:	1240								
L2	:	1								
P2	:	2200	2300							

```
T2    :  3300
X2    :  1380
L3    :     1
T3    :  4520
X3    :  1470  1570
L4    :     1
T4    :  4530
X4    :  1560
T5    :  4540
A[]   :     1
M[]   :     1
Q[]   :     1
T[]   :  1060  1160
X[]   :     1
Z[]   :     1
A$    :   120  1060  1690
C$    :     2  2120
D$    :     2
E$    :     2  1730  1790  1810  1840  1850  1870  1880  1930
         1960  1970  1990  2000  2030  2090  2100  2110
G$    :  1060  2830  2840  4210  4320  4340
H$    :  1070  3060  4220  4330  4350
I$    :     3
N$    :     3
O$    :     3
Q$    :     3  2580  2600  2620  2650  2700
W$    :     3
C0$   :     2  2710
D0$   :  1060  2880  3000  4470  4490  4510
G0$   :  1060  3440  3700  3710  3950  3960  4200  4290  4310
         4610  4920  4930  9240  9250  9290  9300  9310  9320  9330
         9510  9530
N0$   :  1070  4370  4400  4420  4450
R0$      1070  8060  8080  8090  8140  8240  8280
S0$   :  1070  2810  3140  3180  3260  4550  4560  4570  4650
         4660  8100  8150
C1$   :     2  2420
D1$   :     2
E1$   :     2  2170  2220  2320  2390
G1$   :  1060  3070
R1$   :  1070  8060  8110  8160
W1$   :     3


NUMBER OF VARIABLES USED = 59
NUMBER OF ASSIGNMENT STATEMENTS = 182
```

Variable listing of variables assigned in IDSS00

DATE TABLE PRODUCED: 11:22 APRIL 8, 1978
DATE LAST MODIFIED: 7703 11 11:27

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	. .	...	. .	...	...	..	000	000	...	..
B	...	...	000	000	...	...	...	...	...	...	...	. .	...	..	...
C	...	...	...	...	...	...	...	...	...	...	000	...	000	000	000
D	...	...	...	...	...	...	...	...	...	...	...	...	000	..	000
E	...	...	...	...	...	...	...	...	...	...	...	...	000	...	000
F	000	...	000	000	...	...	...	...	...	...	...	...	...	...	...
G	...	...	...	...	...	...	...	...	...	...	...	...	000	000	...
H	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...
I	000	...	...	...	...	...	...	...	...	...	...	...	000	...	...
J	000	...	. .	...	...	...	...	...	...	...	...	...	...	...	...
K	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...
L	000	...	000	000	000	000	...	...	...	...	...	...	...	...	...
M	...	...	...	...	...	. .	...	..	..	...	..	000	...	...	...
N	000	..	...	...	...	. .	...	...	. .	...	...	...	000	...	...
O	...	...	...	...	...	..	...	..	...	...	...	...	000	..	. .
P	000	..	000	000	...	...	...	...	...	...	...	...	...	...	...
Q	...	...	...	...	...	...	...	...	...	...	...	000	000	...	...
R	000	000	000	...	...	..	...	...	...	...	000	...	...	...	...
S	...	...	...	...	...	...	..	..	...	...	...	...	...	...	...
T	000	000	000	...	...	...	...	...	...	..	...	...	...	...	...
U	...	...	...	. .	...	. .	...	..	. .	...	...	..	...	...	...
V	...	...	...	...	. .	...	...	. .	...	...	...	..	...	..	...
W	000	...	...	...	...	...	...	..	...	. .	...	...	000	...	000
X	..	...	...	...	...	...	...	..	...	...	...	000	...	...	...
Y	...	...	..	...	...	. .	...	..	. .	000	...	...	...	...	...
Z	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...

F	:	1	9240						
I	:	1370	1850	2120	2550	2910	3180	3390	3620	3680
J	:	1750	2840							
L	:	1	2290	2300						
N	:	1380	1870	1960	2030	2130	2460	2990	3100	3200
		3350								
P	:	2340								
R	:	1	140	1030	1490					
T	:	1010	9300							
W	:	1								
R0	:	9180								
T0	:	3310	3580	3600	9150	9180				
B1	:	2070	2140	2920						
F1	:	1030	1410	1510						
L1	:	1	3230	3290						
P1	:	3480								
R1	:	1								
T1	:	9300								
B2	:	2070	2150							
F2	:	1080	1500							
L2	:	1								
P2	:	3540								

```
L3    :     1
L4    :     1
Y8    :  9300
C9    :  2320
R9    :  3700
A()   :     1  1360  1440
M()   :     1
Q()   :     1  9090
X()   :     1  9100
Z()   :     1  9110  9120  9170  9210
A$    :   120  1020  1050  2790
C$    :     2
D$    :     2  9250
E$    :     2
G$    :  1020  1060  1610  1760  2850
I$    :     3  1600  1890  2900  3660  3670
N$    :     3
O$    :     3  9270
Q$    :     3
W$    :     3  9280
C0$   :     2
G0$   :  1020  2850
C1$   :     2
D1$   :     2  9260
E1$   :     2
W1$   :     3
```

NUMBER OF VARIABLES USED = 47
NUMBER OF ASSIGNMENT STATEMENTS = 109

Variable listing of variables assigned in IDSS01

DATE TABLE PRODUCED: 11:24 APRIL 8, 1978
DATE LAST MODIFIED: 7710.14 10:09

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	...	...	...	...	. .	...	000	000	...	...
B	...	000	...	...	...	...	...	...	...	...	...	...	...	...	...
C	...	...	...	...	...	...	...	...	...	...	..	...	000	000	000
D	...	000	...	...	...	...	..	...	...	...	...	...	000	000	000
E	...	...	...	...	...	..	...	. .	...	...	...	...	000	...	000
F	000	...	...	...	...	...	..	...	...	...	...	...		...	...
G	...	...	...	...	. .	...	...	...	...	...	...	...	...	...	...
H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
I	000	...	...	...	...	...	...	...	...	...	...	...	000	...	...
J	000	...	...	...	...	...	...	...	...	...	...	...	...	...	...
K	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...
L	000	...	000	000	000	000	...	...	...	...	...	...	...	...	...
M	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...
N	...	000	...	...	...	...	...	...	...	...	...	...	000	...	...
O	...	...	...	...	...	...	...	...	...	...	...	...	000	...	...
P	...	000	...	...	...	...	...	...	...	...	...	...	...	...	...
Q	...	...	000	...	...	...	...	...	...	...	...	000	000	...	...
R	000	000	000	...	...	...	...	...	. .	...	...	...	...	...	. .
S	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
T	...	000	...	...	...	. .	...	...	...	...	..	...	...	...	...
U	...	...	...	...	...	...		...	...	...	...	...	...	...	...
V	...	...	. .	...	...	...	...	...	...	...	...	..	...	...	..
W	000	...	...	...	..	. .	...	...	...	..	...	...	000	...	000
X	...	...	...	...	...	...	...	...	...	...	...	000	...	.	...
Y	...	...	. .	...	...	...	...	...	...	...	...	...	...	...	...
Z	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...

F	: 1						
I	: 2020	2150	2630	9290	9440		
J	: 9310						
L	: 1	1470	1480	2780	2790		
R	: 1	190					
W	: 1						
B0	: 1800	2010	2040	2620	2650		
D0	: 9320						
N0	: 1360	1530	1710	2030	2640	2850	2920
P0	: 1650						
R0	9180	9280	9360	9470	9490		
T0	: 1500	1680	1690	2810	2930		
L1	: 1	1490	2800				
Q1	: 1230						
R1	: 1						
L2	: 1						
L3	: 1						
L4	1						
A[]	: 1						
M[]	1						
Q[]	: 1	1250	1810	1880	2160	2370	2490 2960
X[]	: 1						

```
z[]  :     1
A$   :   170  1050
C$   :     2
D$   :     2
E$   :     2
I$   :     3
N$   :     3
O$   :     3
Q$   :     3
W$   :     3
C0$  :     2
D0$  :  1050  2160
C1$  :     2
D1$  :     2
E1$  :     2
W1$  :     3  1310  1390  1570  1650  1700  1900  2030  2280
        2500  2520  2700  2830  2870

NUMBER OF VARIABLES USED = 38
NUMBER OF ASSIGNMENT STATEMENTS = 89
```

Variable listing of variables assigned in IDSS02

DATE TABLE PRODUCED: 11:26 APRIL 8, 1978
DATE LAST MODIFIED: 7703.11 11:19

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	000	...	. .	...	...	...	...	...	..	..	...	000	000	...	...
B	...	000	000	...	...	...	. .	...	...	...	...	...	...	...	...
C	...	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	000	000	000	...	...	...	...	...	...	...	...	000	...	000
E	...	...	...	...	...	...	...	...	...	...	...	...	000	...	000
F	000	000	...	000	...	...	...	...	...	...	...	...	...	...	...
G	...	...	...	...	...	...	...	...	...	..	...	...	000	000	...
H	...	...	...	...	...	...	...	...	...	...	...	. .	000	...	. .
I	000	...	...	...	...	...	...	...	...	...	...	...	000	...	...
J	000	...	...	...	. .	...	...	...	...	...	...	...	...	. .	...
K	...	...	...	...	...	...	...	...	...	...	...	...	...	. .	...
L	000	...	000	000	000	000	...	...	...	..	...	. .	...	...	...
M	...	...	...	...	...	...	...	...	...	. .	..	000	...	...	...
N	...	000	000	...	...	...	...	...	...	...	...	. .	000	...	...
O	...	...	...	000	...	...	...	. .	...	...	..	...	000	...	...
P	...	000	...	...	...	...	...	...	...	...	...	. .	..	...	...
Q	...	...	...	...	...	...	...	..	..	...	..	000	000	...	...
R	000	000	000	...	...	...	...	...	...	...	...	...	...	000	000
S	...	...	. .	...	...	...	...	...	...	...	...	...	...	...	...
T	...	...	...	...	...	..	...	...	...	..	...	...	...	...	...
U	...	...	...	...	. .	...	...	...	...	...	...	000	...	...	...
V	...	...	...	...	...	...	...	...	. .	...	...	...	...	...	...
W	000	...	...	...	...	...	...	...	...	...	...	...	000	...	000
X	...	000	...	...	...	...	...	...	...	...	...	000	...	...	...
Y	...	...	...	...	...	...	...	...	...	...	...	. .	...	...	...
Z	...	000	...	...	...	...	...	. .	...	...	...	000	...	...	...

A	:	2330						
F	:	1						
I	:	1310	3840	8050				
J	:	8070						
L	:	1	1430	1530	1540	1870	2740	2900	2910
R	:	1	190						
W	:	1							
B0	:	1410	2450						
D0	:	8080							
F0	:	1430							
N0	:	1420	1610	1910	2990	3310	3710	3765	
P0	:	1710	3180						
R0	:	8040	8120						
X0	:	1740							
20	:	2510							
B1	:	1130	1410	2440					
D1	:	1270							
L1	:	1	1440	1550	1580	1790			
N1	:	3675							
R1	:	1	2150	2750	2880	3060	3150	3380	
D2	:	3700							
F2	:	1130	3350	9940	9960				

```
L2    :     1  2090  2590
O2    :  3760
L3    :     1  2090  2720  2920  2960  3190
L4    :     1
A[]   :     1
M[]   :     1  1330  1560  1730  1840  2070  2080  2310  2340
         2370  2420  2580  2710  2930  3240
Q[]   :     1  3880  4000
U[]   :  1050  1770  1810  3220  3230
X[]   :     1
Z[]   :     1  2520  2540
A$    :   170  1050
C$    :     2
D$    :     2  3730  3740
E$    :     2
G$    :  1050  9280
H$    :  1050
I$    :     3
N$    :     3
O$    :     3  3780  3790
Q$    :     3
W$    :     3  3800  4060
CU$   :     2
G0$   :  1050
R0$   :  1050
C1$   :     2
D1$   :     2  1140  1280  3640
E1$   :     2
R1$   :  1050
W1$   :     3  1150  1290  2210  3470  3490  3510  3550

NUMBER OF VARIABLES USED = 51
NUMBER OF ASSIGNMENT STATEMENTS = 132
```

Variable listing of variables assigned in IDSS03

DATE TABLE PRODUCED: 11:29 APRIL 8, 1978
DATE LAST MODIFIED: 7804.05 22:15

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	...	...	...	...	...	...	000	000	..	...
B	...	000	...	...	...	...	...	...	...	...	...	...	...	...	...
C	...	...	000	000	...	...	...	..	...	...	...	...	000	000	000
D	...	...	...	...	...	...	...	...	...	...	...	...	000	000	000
E	...	...	...	...	...	..	...	...	..	...	...	..	000	..	000
F	000	...	000	...	...	...	...	...	...	...	...	...	...	...	...
G	. .	...	...	...	...	...	...	...	..	..	...	...	...	000	...
H	...	...	...	...	...	...	...	...	. .	...	.	...	...	...	..
I	000	000	...	...	...	...	...	...	...	...	...	..	000	...	. .
J	000	...	...	...	...	...	...	...	...	...	..	...	...	..	...
K	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
L	000	...	000	000	000	000	...	...	...	...	..	...	...	...	..
M	...	...	...	...	...	...	...	.	...	...	..	000	...	..	...
N	...	000	...	...	...	...	...	..	..	...	...	...	000	...	...
O	...	...	...	...	...	...	...	...	...	...	..	...	000	...	...
P	...	000	...	...	...	...	...	...	...	...	...	...	. .	...	...
Q	...	...	...	...	...	...	...	...	...	...	...	000	000	...	...
R	000	000	000	...	...	. .	...	...	...	...	...	...	...	...	...
S	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...
T	...	000	...	...	...	...	...	...	..	...	...	000	...	...	...
U	...	...	...	...	...	...	...	...	...	...	...	. .	...	...	...
V	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W	000	..	...	...	...	...	...	...	...	...	...	..	000	000	000
X	...	...	000	...	000	...	...	..	..	...	...	000	...	...	..
Y	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...
Z	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...

F	: 1								
I	: 1220	2190	2840	3440	3630	3780	3860	3940	4080
	9660								
J	: 3910								
L	: 1	1570	1580	3020	3030				
R	: 1	140							
W	: 1								
B0	: 1910	2180	2210	2830	2860				
I0	: 9210								
N0	: 1450	1630	1820	2200	2850	3080	3210	3310	
P3	: 1260	1770	3220						
R3	: 9390	9200	9670						
T0	: 1590	1790	1800	3040	3260				
C1	: 3610	3670							
F1	: 1040	3240							
L1	: 1								
R1	: 1	9770	9790						
X1	: 1160								
C2	: 3620	3710							
L2	: 1								
L3	: 1								
X3	: 1440	1480	1610	1640	1760	1810	2010	2250	2470
	2690	2710	2910	3060	3100				

```
L4    :     1
A[]   :     1
M[]   :     1
Q[]   :     1  4110
T[]   :  1060  3590  3650  3660  3690  3700
X[]   :     1  1360  1370  3250  3270  3460  3470  3790  3800
        3920  3930  4130  4140
Z[]   :     1
A$    :   120  1060
C$    :     2
D$    :     2
E$    :     2
I$    :     3
N$    :     3
O$    :     3
Q$    :     3
W$    :     3  4120
C0$   :     2
D0$   :  1060  2350
G0$   :  1060  9460  9470  9610  9620  9630  9640  9650  9830
        9850
W0$   :  1240
C1$   :     2
D1$   :     2
E1$   :     2
W1$   :     3  1140  3280

NUMBER OF VARIABLES USED = 45
NUMBER OF ASSIGNMENT STATEMENTS = 128
```

Variable listing of variables assigned in IDSS04

DATE TABLE PRODUCED: 11:32 APRIL 8, 1978
DATE LAST MODIFIED: 7709.01 20:15

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	...	...	...	...	...	...	000	000	...	...
B	...	000	...	...	...	...	...	...	...	...	...	...	..	...	...
C	000	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	000	...	000	...	...	...	...	...	...	...	..	000	000	000
E	...	...	...	...	...	...	...	..	...	...	...	...	000	...	000
F	000	...	000	...	...	...	...	...	...	...	...	...	...	..	...
G	...	...	...	...	...	...	...	...	...	...	..	...	000	000	000
H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
I	000	000	000	...	...	...	...	...	...	...	000	...	000	...	...
J	000	. .	...	...	...	...	...	..	...	...	...	...	...	...	...
K	...	...	...	...	...	...	...	...	...	...	...	...	...	...	000
L	000	..	000	000	000	000	...	...	...	...	...	...	...	...	...
M	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...
N	...	000	...	...	...	...	...	...	...	...	...	...	000	...	...
O	...	...	...	000	...	...	...	...	...	...	...	...	000	...	...
P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Q	...	000	...	...	...	...	...	...	...	...	...	000	000	...	...
R	000	000	000	...	...	...	...	...	...	...	...	...	...	...	...
S	...	000	...	...	...	...	...	...	...	...	...	...	...	...	...
T	000	...	...	...	...	...	...	...	...	...	...	...	...	...	...
U	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W	000	...	...	...	...	...	...	...	...	...	...	...	000	...	000
X	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...
Y	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Z	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...

C	:	1060	2320	2380	2760
F	:	1			
I	:	1060	2620	8070	9290
J	:	8090			
L	:	1			
R	:	1	180		
T	:	1010			
W	:	1			
B0	:	1990	2030		
D0	:	8100			
I0	:	1060	1320	2020	2440
N0	:	3855			
Q0	:	3560			
R0	:	8060	8140	9300	
S0	:	1890			
F1	:	3550	3570		
I1	:	1060	2230	2310	
L1	:	1			
R1	:	1	9400	9420	
D2	:	3850			
L2	:	1			
O2	:	3730			

```
L3    :     1
L4    :     1
I9    :  3340  3390
A[]   :     1
M[]   :     1
Q[]   :     1  3680
X[]   :     1
Z[]   :     1
A$    :   160  1020  3400
C$    :     2
D$    :     2  3870  3880
E$    :     2
G$    :  1020  1330  2630  3350  3400
I$    :     3
N$    :     3
O$    :     3  3750  3760
Q$    :     3
W$    :     3  3710
C0$   :     2
D0$   :  1020  2820  2840  2920  2960  2980  3010  3040  3060
         3070  3110  3130  3140  3150  3180  3190  3200  3210  3510
G0$   :  1020  1220  1230  1330  1450  1460  9090  9100  9240
         9250  9260  9270  9280  9460  9480
C1$   :     2
D1$   :     2
E1$   :     2
G1$   :  1020  1750  1880  2220
K1$   :  1020  2390
W1$   :     3  1870  1900  2400  3520  3530

NUMBER OF VARIABLES USED = 49
NUMBER OF ASSIGNMENT STATEMENTS = 121
```

Variable listing of variables assigned in IDSS05

DATE TABLE PRODUCED: 11:34 APRIL 8, 1978
DATE LAST MODIFIED: 7708.09 12:26

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	. .	...	...	...	...	...	...	...	...	...	000	000	...	...
B	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C	...	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	...	...	...	...	...	...	...	...	...	...	...	000	...	000
E	...	...	...	...	...	...	...	...	...	...	...	...	000	...	000
F	000	..	...	...	...	...	...	...	...	...	...	...	...	...	...
G	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
I	...	...	...	...	...	...	...	...	...	...	...	...	000	...	...
J	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
K	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
L	000	...	000	000	000	000	...	...	...	...	...	...	...	...	...
M	...	...	...	...	. .	...	...	...	...	...	...	000	...	...	...
N	...	...	...	...	...	...	...	...	...	...	...	...	000	...	...
O	...	...	...	...	...	...	...	...	...	...	...	...	000	...	...
P	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Q	...	...	...	...	...	...	...	...	...	...	...	000	000	...	...
R	000	...	000	...	...	...	...	...	...	...	...	...	...	...	...
S	...	...	...	...	...	...	...	...	. .	...	...	...	...	...	...
T	000	...	...	...	...	...	...	...	...	...	...	...	...	...	...
U	...	...	...	. .	...	...	...	...	...	...	...	...	...	...	...
V	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W	000	...	...	...	...	...	...	...	...	...	...	...	000	...	000
X	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...
Y	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Z	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...

F	:	1	
L	:	1	
R	:	1	140
T	:	1005	
W	:	1	
L1	:	1	
R1	:	1	
L2	:	1	
L3	:	1	
L4	:	1	
A[]	:	1	
M[]	:	1	
Q[]	:	1	
X[]	:	1	
Z[]	:	1	
A$	:	120	
C$	:	2	
D$	:	2	
E$	:	2	
I$	:	3	
N$	:	3	
O$	:	3	

```
Q$    :     3
W$    :     3
C0$   :     2
C1$   :     2
D1$   :     2
E1$   :     2
W1$   :     3

NUMBER OF VARIABLES USED = 29
NUMBER OF ASSIGNMENT STATEMENTS = 30
```

Variable listing of variables assigned in IDSS06

DATE TABLE PRODUCED: 11:36 APRIL 8, 1978
DATE LAST MODIFIED: 7708.16 13:00

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	...	...	...	...	...	...	000	000	...	...
B	...	000	...	...	...	...	...	...	...	...	...	. .	000	...	...
C	...	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	. .	...	...	...	...	...	...	...	...	...	...	000	...	000
E	...	...	...	...	...	...	...	...	...	...	...	...	000	...	000
F	000	...	000	000	000	...	...	...	...	...	...	...	...	...	. .
G	...	...	...	...	...	...	...	...	...	...	...	...	000	000	...
H	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...
I	000	000	000	...	...	...	...	...	...	...	...	...	000	...	...
J	000	...	...	...	...	...	...	...	...	...	...	...	...	..	...
K	...	...	...	...	...	. .	...	. .	...	. .	...	...	...	...	...
L	000	...	000	000	000	000	...	...	...	...	. .	...	...	...	...
M	...	..	...	...	...	...	...	...	..	...	...	000	...	...	...
N	000	...	...	...	...	...	...	...	...	...	...	...	000	...	...
O	...	...	...	...	...	...	...	...	...	...	...	...	000	...	...
P	000	...	...	...	...	...	...	...	...	...	...	...	.	...	...
Q	...	000	...	...	...	...	...	...	...	...	...	000	000	...	...
R	000	000	000	000	000	...	...	...	...	...	...	...	...	000	000
S	000	...	...	...	...	...	...	...	...	...	...	..	...	000	...
T	...	...	...	...	...	...	..	...	...	...	...	000	...	...	...
U	...	...	...	...	...	...	...	...	...	.	...	...	...	...	...
V	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W	000	...	...	...	...	..	...	...	...	...	...	...	000	...	000
X	...	. .	000	...	...	...	...	...	...	...	...	000	...	...	...
Y	...	...	...	...	...	. .	...	...	...	...	...	...	...		...
Z	...	...	...	...	...	...	...	. .	..	...	...	000	...	...	...

F	:	1								
I	:	4469	8260							
J	:	1380	4660							
L	:	1	2180							
N	:	1130	1250	4470						
P	:	1420	4740	9250						
R	:	1	140							
S	:	1140								
W	:	1								
B0	:	1230	1260	4450	4480					
I0	:	9490								
Q0	:	9100								
R0	:	8270								
F1	:	2190	2230	9090	9110	9110				
I1	:	1530	4850							
L1	:	1								
R1	:	1	1520	1570	8370	8390				
X1	:	1240								
F2	:	2190	2250	2490	8960	8560				
L2	:	1								
R2	:	1350	1590	1700	1740	2330	2380	4630	4780	4890
		4980	5010							

```
F3    :  2190  2280
L3    :     1
R3       4900  9350
L4    :     1
A[]   :     1
M[]   :     1
Q[]   :     1  9190
T[]   :  1060  1115
X[]   :     1
Z[]   :     1  1010
A$    :   120  1110  1390  1400  1440  1770  1790  1960  1970
         2140  2150  4670  4720  4760  5040  9270
B$    :  1110  1540  4860
C$    :     2
D$    :     2  4360  5240  5250
F$    :     2
G$    :  1110  4080  4120  4160  4170
I$    :     3
N$    :     3
O$    :     3  4340  5150  5160
Q$    :     3
W$    :     3  4320  5120
C0$   :     2
G0$   :  1110  8050  8070  8210  8220  8230  8240  8250
R0$   :  1110  9360  9380  9390  9440  9540  9580
S0$   :  1110  1360  1580  1710  1750  2340  2370  2480  4640
         4910  4990  5020  5060  8440  8460  9400  9450
C1$   :     2
D1$   :     2
E1$   :     2
R1$   :  1110  9360  9410  9460
W1$   :     3  1070  4230  4250  5090  5110

NUMBER OF VARIABLES USED = 51
NUMBER OF ASSIGNMENT STATEMENTS = 156
```

Variable listing of variables assigned in IDSS07

DATE TABLE PRODUCED: 11:38 APRIL 8, 1978
DATE LAST MODIFIED: 7708.04 15:23

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	...	...	...	...	...	000	000	...	...
B	...	. .	...	...	...	...	...	. .	...	...	...	...	...	...
C	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	...	...	...	...	. .	...	...	...	...	...	000	...	000
E	...	...	...	...	. .	...	...	...	...	...	...	000	...	000
F	000	...	...	...	...	...	...	...	...	...	...	...	...	...
G	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H	...	...	...	...	...	. .	...	...	...	...	...	...	...	...
I	...	...	...	...	...	. .	...	...	...	...	...	000	...	...
J	...	...	...	...	...	...	...	...	...	...	...	...	...	...
K	...	...	...	. .	..	. .	...	...	..	...	...	...	...	...
L	000	..	000	000	000	000	...	...	...	...	...	. .	...	..
M	...	...	...	...	...	...	...	...	. .	...	...	000	...	...
N	...	...	...	...	...	...	...	...	...	...	...	...	000	...
O	...	...	...	. .	...	...	...	...	...	...	. .	...	000	...
P	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Q	...	...	...	...	...	...	...	...	...	..	...	000	000	...
R	000	...	000	...	...	...	...	...	...	...	...	...	...	...
S	...	...	. .	...	...	...	...	. .	...	.	...	...	...	...
T	000	..	...	...	. .	...	...	...	...	..	...	...	...	...
U	...	...	...	...	...	...	. .	...	...	...	...	...	...	...
V	...	...	. .	...	...	...	...	...	...	...	...	...	...	...
W	000	...	...	...	...	...	...	...	...	...	. .	...	000	...	000
X	...	...	...	...	...	...	...	...	...	...	000	...	...	...
Y	...	...	...	...	...	...	...	...	...	...	..	. .	...	...
Z	...	. .	...	...	...	...	...	...	...	...	000	...	...	...

F	:	1	
L	:	1	
R	:	1	140
T	:	1005	
W	:	1	
L1	:	1	
R1	:	1	
L2	:	1	
L3	:	1	
L4	:	1	
A[]	:	1	
M[]		1	
Q[]	:	1	
X[]	:	1	
Z[]	:	1	
A$		120	
C$	:	2	
D$	:	2	
E$	:	2	
I$	:	3	
N$	:	3	
O$	:	3	

```
Q$      :       3
W$      :       3
C0$     :       2
C1$     :       2
D1$     :       2
E1$     :       2
W1$             3

NUMBER OF VARIABLES USED = 29
NUMBER OF ASSIGNMENT STATEMENTS = 30
```

Variable listing of variables assigned in IDSSPM

DATE TABLE PRODUCED: 12:29 APRIL 8 1978
DATE LAST MODIFIED: 7708.30 11:00

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	000	...	...	...	..	...	. .	..	..	...	...	...	000	...	..
B	..	...	...	...	...	..	...	..	...	...	...	...	. .	...	..
C	...	000	000	...	...	..	...	...	...	...	..	..	...	...	..
D	...	..	...	...	..	. .	...	...	..	...	..	..	...	...	..
E	...	..	...	...	...	..	...	...	...	...	...	..	..	..	...
F	...	..	000	000	...	...	...	...	..	...	...	..	..	...	...
G	...	...	. .	...	...	. .	...	..	...	...	...	...	000	000	...
H	...	...	000	...	...	...	.	..	...	...	...	...	000	..	.
I	000	000	000	..	...	.	...	..	...	...	...	..	000	...	...
J	...	000	...	...	. .	..	. .	...	...	.	. .	...	...	...	...
K	...	..	. .	...	..	...	..	...	...	...	..	.	...	. .	...
L	000	...	...	...	...	...	. .	...	...	...	...	...	...	. .	. .
M	...	...	...	...	. .	...	..	..	.	..	..	. .	. .	...	...
N	...	...	000	...	...	..	...	...	. .	...	. .	..	...	...	.
O	...	...	. .	..	...	...	..	...	..	...	.	...	..	...	...
P	...	...	000	000	000	...	...	...	...	...	..	000	..	...	...
Q	...	...	. .	. .	. .	..	...	. .	..	...	...	. .	..	..	...
R	000	000	000	000	...	...	...	...	..	...	..	.	...	...	...
S	...	000	.	...	...	.	...	. .	...	...	.	...	...	...	...
T	. .	000	000	000	...	...	.	. .	..	..	...	...	. .	..	...
U	...	...	...	...	...	..	...	...	...	...	..	.	.	...	..
V	...	...	...	...	.	...	...	...	...	...	..	..	...	. .	. .
W	...	...	...	..	..	.	. .	...	. .	.	.	...	...	...	...
X	...	. .	000	. .	...	...	. .	...	000	000	000	...	000	...	..
Y	...	...	...	...	...	...	...	.	...	..	..	. .	..	...	...
Z	...	...	. .	...	...	...	...	...	..	...	..	..	..	...	..

A	:	1310							
I	:	1180	1520	2770	3800	3940	4330		
L	:	8510							
R	:	1920							
C0	:	8020	8250						
I0	:	8370	8170	8350	9090				
J0	:	9120							
R0		2060	2340	3490	3630	8460	8540	8570	8620	8710
		8310							
S0	:	1660	1810						
T0		3110							
C1	:	8030	8260						
F1	:	8590							
H1	:	2600	3430	4200					
I1	:	2040							
N1		3900							
P1	:	2330	4260	4440	8040	8240			
R1	:	2710	3920						
T1	:	9100							
X1	:	1210	4090						
F2	:	8590							
P2	:	1990	2330	2660	2850	3060	4410	8110	

```
R2    :  2760  2860
T2    :  9100                                  70
P3    :  1990  2660  4410  8110
X7    :  1090
X8    :  1100
X9    :  1110
P[]   :  1010  1170  2680  3160  3230  4080  4270
A$       1020  1270  1290
G$    :  1020  2110  2780
H$       1020  1530  3500  3610  3970  3990  4360
I$    :  1020  1640  1900  2020  2170  2180  2300  2310  2580
         2990  3000  3410  3530  3540  4040  4050  4180  8480  8490
X$       1020  2210  2230  2250  2270  2900  2920  2940  2960
         8180
G0$   :  1020  3950  4340  8050  8120  8560  8610  8730  9130

NUMBER OF VARIABLES USED = 34
NUMBER OF ASSIGNMENT STATEMENTS = 123
```

```
X[]  :     1
Z[]  :     1
A$   :  1050  1120  1280  1350  1570  1580  1650  2120  2123
        2124  2125
C$   :     2
D$   :     2
E$   :     2  1034
G$   :  1050  1290  1320  1410  1660  1700  1740  1770  1780
        1840  1850  1910  1920  2140
I$   :     3  1960
N$   :     3  1720
O$   :     3
Q$   :     3  1006
R$   :  1655
W$   :     3
C0$  :     2
I0$  :  1050  9370  9380
R0$  :  1050
C1$  :     2
D1$  :     2
E1$  :     2  1005
R1$  :  1050
W1$  :     3

NUMBER OF VARIABLES USED = 43
NUMBER OF ASSIGNMENT STATEMENTS = 97
```

Variable listing of variables assigned in IDSSPS

DATE TABLE PRODUCED: 12:32 APRIL 8 1978
DATE LAST MODIFIED: 7803 18 11 24

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	. .	...	...	...	...	...	...	000	000	...	...
B	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C	000	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	...	...	...	...	...	...	...	...	...	...	...	000	...	000
E	...	...	...	...	...	...	...	...	...	...	...	...	000	...	000
F	000	...	000	..	...	...	...	. .	...	..	..	...	...	..	...
G	...	...	...	...	...	...	. .	...	...	.	...	...	000	...	...
H	...	...	...	...	...	...	...		. .	.	.	...	...	...	...
I	000	000	..	...	...	...	...	...	...	...	. .	...	000	000	...
J	...	...	...	...	...	..	...	...	...	...	..	..	...	...	...
K	...	...	...	...	...	...	...	. .	..	...	...	..	...	. .	...
L	000	...	000	000	000	000	..	...	..	..	...	...	..	...	...
M	...	...	...	...	...	. .	..	. .	...	...	..	000	...	...	...
N	000	...	000	...	...	..	...	...	...	..	..	...	000	...	...
O	...	...	...	...	...	...	. .	...	...	...	...	...	000	...	...
P	...	...	..	...	..	...	...	...	...	. .	. .	000	...	...	..
Q	...	..	...	...	...	...	...	. .	...	..	..	000	000	...	...
R	000	...	000	...	. .	..	...	...	.	. .	000	..	000	000	000
S	...	...	...	...	...	...	...	. .	...	...	...	..	..	...	. .
T	...	...	000	...	. .	..	. .	...	...	...	...	..	..	...	...
U	...	...	...	...	. .	..	...	...	...	. .	...	...	...	...	...
V	...	...	...	...	...	...	..	. .	...	...	...	...	...	...	..
W	000	...	...	...	...	. .	...	. .	...	..	...	...	000	...	000
X	...	. .	000	...	. .	. .	...	. .	...	...	...	000	...	...	. .
Y	...	...	. .	...	. .	...	...	. .	...	. .	. .	..	...	...	...
Z	...	...	...	...	...	..	...	...	...	. .	...	000	...	...	...

C	:	1370				
F	:	1	1010	1810	1940	2070	2155
I	:	1270				
L	:	1				
N	:	1480	1510			
R	:	1	2012			
W	:	1				
I0	:	9340				
F1		1743	1895	2159	9495	9695
L1	:	1				
N1		1480				
R1	:	1				
T1	:	1130				
X1	:	1210	1240			
L2	:	1				
L3	:	1				
L4		1				
R9	:	1640				
A[]	:	1	1930	1990	2010	
M[]	:	1	1010	1950	2080	2156
P[]	:	1050	1200	1340	1500	1500	1870
Q[]		1				

```
D$          2
E$      :   2
G$      :   120   1650
I$      .   3
N$      :   3
O$      :   3
Q$      :   3
W$      :   3
C0$     :   2
G0$     :   120   3000   9090   9100   9240   9250   9260   9270   9280
            9460  9480
C1$     :   2
D1$     :   2
E1$     :   2
W1$     :   3

NUMBER OF VARIABLES USED = 35
NUMBER OF ASSIGNMENT STATEMENTS = 72
```

Variable listing of variables assigned in DIALOG

DATE TABLE PRODUCED: 12:34 APRIL 8 1978
DATE LAST MODIFIED: 7804.03 19:50

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A											000	000		
B														
C		000										000	000	000
D												000		000
E												000		000
F	000													
G												000	000	
H														
I	000											000		
J														
K														
L	000		000	000	000	000								
M											000			
N												000		
O												000		
P														
Q											000	000		
R	000	000	000	000										
S														
T	000													
U														
V														
W	000											000		000
X											000			
Y														
Z											000			

F	:	1	1020								
I	:	2930	2990	9290							
L	:	1									
R	:	1	210								
T	:	1040									
W	:	1									
C0		1490	1510								
R0	:	9300									
L1		1									
R1	:	1	9400	9420							
L2	:	1									
R2	:	160									
L3	:	1									
L4	:	1									
A[]	:	1									
M[]	:	1	9015								
Q[]	:	1									
X[]	:	1									
Z[]	:	1									
A$	:	120	130	150	160	190	200	1070	1130	1140	
		1520	1540	1620	1670	1690	2320	2330	2520	3410	3430
C$	:	2									

```
X[]  :     1
Z[]  :     1
A$   :   120  1010  1140  1140  1500  1500
C$   :     2
D$   :     2
E$   :     2
G$   :  1010  1270  1280  1290  9260  9270
H$   :  1010  1500
I$   :     3  1140  1165  1320  1340  1390  1400  1410
N$   :     3
O$   :     3
Q$   :     3
W$   :     3
C0$  :     2
C1$  :     2
D1$  :     2
E1$  :     2
W1$  :     3

NUMBER OF VARIABLES USED = 40
NUMBER OF ASSIGNMENT STATEMENTS = 64
```

Variable listing of variables assigned in IDSSOP

DATE TABLE PRODUCED: 12:36 APRIL 8, 1978
DATE LAST MODIFIED: 7708.29 15:37

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	. .	...	...	...	...	...	...	...	...	...	000	000	...	...
B	...	...	...	...	...	...	...	...	...	..	..	...	...	...	...
C	...	000	...	...	...	...	...	...	..	...	..	...	000	000	000
D	...	...	...	...	...	.	...	...	..	...	. .	...	000	...	000
E	...	. .	...	...	..	...	...	...	...	...	...	..	000	...	000
F	000	...	...	...	...	. .	...	...	...	...	...	..	...	...	...
G	...	...	...	...	...	...	...	...	...	...	...	...	000	...	...
H	...	...	...	...	...	...	..	...	..	...	...	..	000	...	...
I	000	...	...	...	...	...	. .	...	..	...	...	...	000	...	...
J	000	...	...	...	...	. .	.	...	...	...	...	...	...	...	...
K	...	...	...	...	...	...	..	...	...	..	...	...	...	...	...
L	000	..	000	000	000	000	...	..	...	...	...	...	...	...	...
M	...	...	...	...	...	...	...	...	...	..	..	000	...	...	...
N	...	...	...	...	...	. .	...	..	...	...	...	...	000	...	...
O	...	...	.	. .	.	...	...	...	..	...	...	...	000	...	..
P	...	...	...	...	...	...	. .	...	...	...	...	...	...	...	. .
Q	...	...	...	...	...	...	...	...	...	...	...	000	000	...	. .
R	000	...	000	...	...	...	...	...	...	...	000	...	...	...	...
S	...	...	...	...	...	. .	...	..	..	...	...	...	...	...	...
T	000	000	000	000	000	000	...	...	...	..	...	...	...	...	...
U	...	...	...	...	...	...	...	...	...	. .	...	..	. .	...	...
V	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...
W	000	...	...	...	...	...	...	...	...	...	..	...	000	...	000
X	...	...	...	. .	...	...	...	...	...	...	...	000	...	...	...
Y	...	. .	...	...	...	...	...	...	...	...	..	...	...	...	...
Z	...	...	...	. .	...	...	...	...	...	...	..	000	...	...	...

F	:	1			
I	:	9150			
J	:	9160			
L	:	1			
R	:	1	150	1540	9170
T		1005	1260	1330	
W	:	1			
C0		1470	1510		
T0	:	1210			
L1	:	1			
R1	:	1			
T1	:	1220			
L2	:	1			
T2		1230			
L3	:	1			
T3	:	1240			
L4	:	1			
T4	:	1310			
R9	:	1570			
A[]	:	1			
M[]	:	1			
Q[]	:	1			

```
L4    :      1
R9    :   1150   1150   2310   2590
T9    :   1860   2020   2110
A[]   :      1
M[]   :      1   1006
Q[]   :      1
X[]   :      1
Z[]   :      1
A$    :    170   1020   1087   1090   1095   1100   1680   1766   1767
C$    :      2
D$    :      2
E$    :      2
G$    :   1020   1105   1530   1600   9070   9220   9230
H$    :   1020   1410   1860   2260   9020   9050   9380   9420
I$    :      3   1720   1772   1780   2090   2180   2430   2440   2450
         2460   2470   2490   2520
N$    :      3   1108   1200   1320   1380   1430   1730   2605   2650
O$    :      3
Q$    :      3
T$    :   1030   1740   1910
W$    :      3
A0$   :   1020   1690
C0$   :      2
N0$   :   1020   1450   2630   2635   2640   2645
A1$   :   1020   1690
C1$   :      2
D1$   :      2
E1$   :      2
W1$   :      3

NUMBER OF VARIABLES USED = 50
NUMBER OF ASSIGNMENT STATEMENTS = 120
```

Variable listing of variables assigned in IDSSON

DATE TABLE PRODUCED: 12:38 APRIL 8, 1978
DATE LAST MODIFIED: 7805.05 17:55

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	OOO	...	...	...	...	...	...	...	...	...	...	OOO	OOO	OOO	OOO
B	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C	OOO	OOO	...	...	...	...	...	...	...	...	...	...	OOO	OOO	OOO
D	...	...	...	...	...	...	...	...	...	...	...	...	OOO	...	OOO
E	...	...	...	..	...	...	...	...	...	...	...	...	OOO	...	OOO
F	OOO	...	...	OOO	...	...	...	...	..	..	...	...	...	...	...
G	...	OOO	OOO	...	...	...	...	...	...	...	...	..	OOO	...	...
H	...	...	...	...	...	...	...	...	...	...	...	...	OOO	...	...
I	OOO	...	...	...	...	...	...	...	...	...	.	...	OOO	...	...
J	OOO	...	...	...	...	...	...	...	...	...	...	...	...	...	...
K	OOO	...	...	...	...	...	.	...	...	...	.	...	...	...	...
L	OOO	..	OOO	OOO	OOO	OOO	...	..	..	...	...	...	...	...	...
M	...	...	...	...	...	.	..	..	...	...	...	OOO	..	...	...
N	...	...	...	...	...	...	...	...	...	.	...	...	OOO	OOO	...
O	...	...	...	...	.	.	...	...	...	...	..	...	...	OOO	..
P	OOO	..	..	...	...	...	.	...	...	...	...	...	...	..	...
Q	...	...	...	...	...	...	..	..	..	.	...	OOO	OOO	...	.
R	OOO	...	OOO	...	...	.	...	..	...	.	OOO	...	...	...	..
S	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
T	OOO	OOO	OOO	OOO	...	.	...	...	...	...	OOO	...	OOO	..	...
U	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
V	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..
W	OOO	..	...	...	...	...	...	...	...	...	...	...	OOO	...	OOO
X	...	...	...	...	...	...	...	...	...	...	...	OOO	...	...	...
Y	...	.	.	...	...	...	...	...	...	.	...	...	...	...	...
Z	...	...	...	...	...	...	...	...	...	...	...	OOO	...	...	...

A :	2020	2110	2500	2510
C :	1660	1690	2340	
F :	1	1096	1107	
I	1280	9030	9130	
J :	9140			
K :	9390			
L :	1			
P :	1440			
R :	1	190	9150	
T :	1005			
W :	1			
C0 :	2240	2270		
G0 :	1540			
T0 :	2400			
G1 :	1542			
L1 :	1			
R1 :	1	1082	1084	
T1 :	2410			
F2 :	1100			
L2 :	1			
T2 :	2420			
L3 :	1			

```
Q[]  :     1
X[]  :     1
Z[]  :     1
A$   :   120  1030
C$   :     2
D$   :     2
E$   :     2
G$   :  1030  1090  1220  1800  1840  1850  2070  2120  2130
        2280  2470  2500  2870  2880  9120
I$   :     3
N$   :     3
O$   :     3
Q$   :     3
W$   :     3
A0$  :  1030
C0$  :     2
G0$  :  1030  1120  1320  1420  2580  2600
C1$  :     2
D1$  :     2
E1$  :     2
W1$  :     3

NUMBER OF VARIABLES USED = 42
NUMBER OF ASSIGNMENT STATEMENTS = 83
```

Variable listing of variables assigned in IDSSPK

DATE TABLE PRODUCED: 12:40 APRIL 8 1978
DATE LAST MODIFIED: 7708.09 12:30

	0	1	2	3	4	5	6	7	8	9	[]	$	0$	1$
A	...	...	...	...	...	...	...	...	...	...	...	000	000	000	...
B	...	000	000	...	...	...	...	...	...	...	...	...	...	...	...
C	...	...	...	...	...	...	...	...	...	...	...	...	000	000	000
D	...	...	...	...	...	...	...	...	...	...	...	...	000	...	000
E	...	...	...	...	...	...	..	..	...	...	...	...	000	...	000
F	000	...	000	000	000	...	...	...	...	...	...	...	...	...	...
G	...	...	...	...	...	...	...	...	...	...	..	...	000	000	...
H	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...
I	...	...	...	...	...	...	...	...	...	...	...	. .	000	...	...
J	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...
K	...	...	. .	...	...	...	...	..	...	...	...	...	...	...	...
L	000	...	000	000	000	000	...	...	...	...	...	...	...	...	...
M	...	...	. .	...	...	...	...	...	...	...	...	000	...	...	..
N	000	...	...	...	...	...	...	...	...	...	...	...	000	...	...
O	...	...	...	...	.	...	...	...	...	...	...	..	000	...	...
P	000	...	000	000	000	...	...	...	...	...	...	...	...	...	. .
Q	...	...	. .	...	...	...	...	...	...	...	...	000	000	...	...
R	000	...	000	...	...	...	..	...	...	...	...	..	...	...	...
S	...	...	...	...	...	...	...	...	...	...	...	...	..	..	...
T	000	...	...	...	...	...	...	...	...	...	...	...	...	...	...
U	...	...	...	...	...	...	...	. .	...	...	..	...	..	...	...
V	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...
W	000	...	...	...	...	...	...	...	...	...	...	...	000	...	000
X	...	...	...	...	...	...	...	...	...	...	...	000	...	...	...
Y	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Z	...	...	...	...	...	...	...	...	...	...	..	000	...	...	...

F	:	1					
L	:	1					
N	:	1210	1680	1750	1940	2010	2380	9400
P	:	1180	1520	2210	2710	2820	2910	9380
R	:	1	140					
T	:	1010						
W	:	1						
B0	:	9320	9410					
B1	:	1900	1950					
F1	:	2350	2450					
L1	:	1						
P1	:	1920	1930	2720	2790			
R1	:	1						
F2	:	2350	2400					
L2	:	1						
P2	:	9330	9340					
F3	:	2320						
L3	:	1						
P3	:	2780						
L4	:	1						
A[]	:	1						
M[]	:	1						

NEXT WITHOUT MATCHING FOR	NEXT statement specifies variable not defined in FOR statement; check variable and include missing FOR statement if necessary. Also returned for improper nesting of FOR . . . NEXT statements; correct and rerun.
OUT OF STORAGE	No more room in user workspace; try to shorten program length.

Error Message	Cause and Corrective Action
SAME FOR-VARIABLE NESTED	A nested FOR statement uses the same for-variable as FOR statement at higher level; check code and change variable.
UNDEFINED FUNCTION	Function references a function that has not been defined; check function name, define function if necesary.
UNDEFINED STATEMENT REFERENCE	Referenced statement does not exist; check statement number, include statement if necessary.
UNMATCHED FOR	FOR statement does not have matching NEXT statement; check for variable and include NEXT statement if missing.
VARIABLE DIMENSIONED TWICE	The same variable has been dimensioned twice; check variable and delete one DIM or COM specification if necessary.

PROGRAMMING ERRORS. The following errors are assigned a number that can be recovered through execution of SYS(0) if an IF ERROR statement has been specified. With the exception of the starred messages, IF ERROR causes the flow of execution to be altered when one of the following errors occurs. Note that the line where the error occurred can be retrieved by executing SYS(1) when IF ERROR was specified.

Error Number	Error Message	Cause and Corrective Action
1	GOSUBS NESTED TWENTY DEEP	No more than 20 GOSUB statements without an intervening RETURN statement can be nested. This error may occur because IF END or IF ERROR causes exit from subroutine without executing RETURN.
2	RETURN WITH NO PRIOR GOSUB	A RETURN statement encountered with no prior GOSUB in the sequence of execution. This error may occur because program has no STOP statement prior to subroutine.

Error Number	Error Message	Cause and Corrective Action
3	SUBSCRIPT OUT OF BOUNDS	An array element specified by a subscript greater than the array dimension.
4	NEGATIVE STRING LENGTH	Second subscript in substring specification is less than the first.
5	NON-CONTIGUOUS STRING CREATED	Values assigned to string variable must be contiguous from left to right; e.g., the following code generates this error: DIM A$(20) A$(1,5)="ABCDE" A$(10,12)="JKL" positions 6-9 of A$ are undefined.
6	STRING OVERFLOW	Number of characters in string literal is greater than dimensions of string variable, or string entered in response to LINPUT, ENTER, INPUT, or READ was larger than dimensions allow.
7	OUT OF DATA	READ statement has come to the end of data in the DATA statements.
8	DATA OF WRONG TYPE	Data in a DATA statement or file is a different type (string or numeric) than corresponding variable.
9	UNDEFINED VALUE ACCESSED	Variable referenced to which no value has been assigned.
10	MATRIX NOT SQUARE	MAT . . . IDN statement requires an array with the same number of rows as columns.
11	REDIMENSIONED ARRAY TOO LARGE	New array dimensions greater than physical dimensions of array specified by DIM.
12	NEARLY SINGULAR MATRIX	Array cannot be inverted (MAT . . . INV); determinant of array is nearly zero.
13	LOG OF NEGATIVE ARGUMENT	Argument of LOG function not a positive value.
14	SQR OF NEGATIVE ARGUMENT	Argument of SQR function not a positive value.
15	ZERO TO ZERO POWER	Exponent of a zero value is itself zero.

Error Number	Error Message	Cause and Corrective Action
16	NEGATIVE NUMBER TO REAL POWER	Exponent is not an integral value and number is negative (e.g., $-2^{1.3}$).
17	TRIG FUNCTION ARGUMENT OUT OF RANGE	Argument of ATN, COS, SIN, or TAN function is outside allowed range; check function descriptions for range and correct.
18	OVER/UNDERFLOW—WARNING ONLY	Result of calculation has produced a number either too large or too small.
*19	LAST INPUT IGNORED, RETYPE IT	Issued after tape mode errors to indicate that last command typed was ignored.
*20	TOO MANY FILES STATEMENTS	Compilation error; more than 4 FILES statements.
21	NON-EXISTENT FILE REQUESTED	Referenced file number not opened by ASSIGN or position not named in FILES statement.
22	WRITE TRIED ON READ ONLY FILE	Attempt to print data to a file from which data may only be read.
23	END-OF-FILE/ END-OF-RECORD	Attempt to sequentially print or read beyond physical end-of-file, or attempt to direct print or read beyond physical end of record or file.
24	STATEMENT NOT IMAGE	Statement referenced in PRINT USING not an IMAGE statement.
*25	NON-EXISTENT PROGRAM REQUESTED	Program named in CHAIN statement not in library, not accessible, or specified incorrectly; may be trapped if return variable specified.
*26	CHAIN REQUEST IS A FILE	Program name, not a file name, must be specified in CHAIN statement; may be trapped if return variable specified.
*27	PROGRAM CHAINED TO IS TOO LARGE	Program named in CHAIN statement is too large for user work space; may be trapped if return variable specified.
*28	COM STATEMENT OUT OF ORDER	COM statements must be lowest numbered statements in program; CHAIN error.

Error Number	Error Message	Cause and Corrective Action
29	ARGUMENT OUT OF RANGE	Function argument is outside legal range.
*30	(not currently used)	
31	BAD FILE READ	Fatal disc error trying to read disc block; contact your operator who may fix the problem or else will call the HP representative.
32	BAD FILE WRITE DETECTED	Fatal disc error trying to write disc block; contact your operator who may fix the problem or else will call the HP representative.
*33	CAN'T READ PROGRAM CHAINED TO	Program named in CHAIN cannot be accessed; may be trapped if return variable specified.
*34	NO ACCESS ALLOWED	Specified program cannot be executed; may be trapped if return variable specified.
*35	PROGRAM BAD	Internal system problems; contact your operator who may fix the problem or else will call your HP representative.
*36	STATEMENT NUMBER OUT OF BOUNDS	Specified statement number does not exist in program chained to; may be trapped if return variable specified.
37	NO ACCESS AT THIS TIME	Device requested in FILES or ASSIGN statement is busy; try again later.
38	ASCII FILE NOT PERMITTED	Attempt to use LOCK, UNLOCK, ADVANCE, UPDATE, REC, ITM, etc., with an ASCII file.
39	RETURN VARIABLE NEEDED	Return variable must be specified in a LOCK because at least one other file is locked.
40	ASCII FILE REQUIRED	LINPUT, PRINT#USING, etc., require an ASCII file; attempt made to use BASIC Formatted file.
41	MISSING OR INVALID COMMAND	Command omitted or not specified correctly or not allowed in SYSTEM statement.

Error Number	Error Message	Cause and Corrective Action
42	READ TRIED ON WRITE-ONLY FILE	Attempt to read from a file to which you only have write access (e.g., LP, PP, etc.)
*43	(not currently used)	
44	RECORD NUMBER NOT ALLOWED	Direct access attempted on ASCII file or file # 0 (your terminal).

FORMAT ERRORS. The following errors, like programming errors, terminate execution unless trapped through the IF ERROR statement. These errors are caused by incorrectly specified formats in IMAGE, PRINT USING, or MAT PRINT USING statements.

Error Number	Error Message	Cause and Corrective Action
100	MISSING FORMAT SPECIFICATION	No format specification in PRINT USING or IMAGE statement.
101	ILLEGAL OR MISSING DELIMITER	Delimiter not comma or slash or is missing.
102	NO CLOSING QUOTE	Format string not terminated by quote.
103	BAD CHARACTER AFTER REPLICATOR	Integer indicating repetition may only precede characters A, D, or X.
104	REPLICATOR ZERO OR TOO LARGE	Replicator must be in range 1 through 255.
105	MULTIPLE SIGNS	Only one sign allowed in a numeric specification.
106	MULTIPLE DECIMAL POINTS	Only one decimal point allowed in a numeric specification.
107	BAD FLOATING SPECIFICATION	Invalid format for a floating point specification in format string (e.g., DD.DDEEE).
108	ILLEGAL CHARACTER IN FORMAT	Character other than A,D,S,E,X,/, a decimal point, or quoted string not allowed in format.
109	ILLEGAL FORMAT FOR STRING	Specification for a number associated with a string variable (e.g., PRINT USING "DD";A$).

Error Number	Error Message	Cause and Corrective Action
110	MISSING RIGHT PARENTHESIS	Right parenthesis missing in grouped format specification.
111	MISSING REPLICATOR	Group must be preceded by integer between 1 and 255 used as repetition factor.
112	TOO MANY PARENTHESES LEVELS	Groups may be nested only two deep.
113	MISSING LEFT PARENTHESIS	Left parenthesis missing in grouped format specification.
114	ILLEGAL FORMAT FOR NUMBER	Format specification is for a string, not a number (e.g., PRINT USING "AAA";A).

EXECUTION WARNINGS. Warning errors occur under the same circumstances as other execution errors. These errors, however, represent conditions that are either recoverable or simply questionable practices and do not terminate execution nor are they trapped by IF ERROR. The associated error numbers may be recovered through execution of SYS(0). When IF ERROR has been specified, the message is not printed.

Error Number	Error Message	Cause and Corrective Action
200	BAD INPUT, RETYPE FROM ITEM	Bad format in item read by INPUT statement; retype items starting with specified item number.
201	LOG OF ZERO — WARNING ONLY	Argument of LOG function evaluates to zero; function value is set to -10^{38}.
202	ZERO TO NEGATIVE POWER — WARNING	Zero raised to negative power (e.g., 0**−1); value set to 10^{38}.
203	DIVIDE BY ZERO — WARNING ONLY	Zero divisor (e.g., 1/0); value set to 10^{38}.
204	EXP OVERFLOW — WARNING ONLY	EXP(x) executed where x greater than 85; value set to 10^{38}.
205	OVERFLOW — WARNING ONLY	Magnitude of result of calculation greater than 10^{38}.
206	UNDERFLOW — WARNING ONLY	Magnitude of result of calculation less than 10^{-38} but not zero.

207	EXTRA INPUT – WARNING ONLY	More items typed in response to INPUT statement than were requested.
208	OVER/UNDERFLOW – WARNING ONLY	Overflow or underflow occurred when reading or writing an ASCII file.
209	TRANSMISSION ERROR. REENTER	Characters entered in response to INPUT or LINPUT statement were either lost or garbled.

ASCII FILE ERRORS. The following errors result from attempts to access ASCII files. Like other execution errors, they cause the program to terminate unless trapped through the IF ERROR statement. The error number is recoverable through SYS(0).

Error Number	Error Message	Cause and Corrective Action
300	NO DATA AVAILABLE ON RJE OR LT	1.) No data found when reading from LT device, and EOF not reached. 2.) No data available from JL or JT device because RJE buffer is full. Unless trapped by IF ERROR, system tries again until data available.
301	DEVICE NOT READY	Device associated with ASCII file is not ready; ready device and restart program.
302	DEVICE ERROR	Card reader improperly read a card; replace card in hopper, and make device ready.
303	ATTENTION NEEDED	Operator attention is required by ASCII file device; invalid Hollerith code read on card reader, or magnetic tape off-line or not at load point when device first accessed.
304	READ/WRITE FAILURE	Power failed on a non-recoverable device (MT, PR) or bad parity read from PR, or no write ring in MT when attempt made to write, etc.

Table A-1. ASCII Character Set

DECIMAL VALUE	GRAPHIC	COMMENTS	ALTERNATE CHARACTER	DECIMAL VALUE	GRAPHIC	COMMENTS
0		Null	@	64	@	Commercial at
1		Start of heading	A	65	A	Uppercase A
2		Start of text	B	66	B	Uppercase B
3		End of text	C	67	C	Uppercase C
4		End of transmission	D	68	D	Uppercase D
5		Enquiry	E	69	E	Uppercase E
6		Acknowledge	F	70	F	Uppercase F
7		Bell	G	71	G	Uppercase G
8		Backspace	H	72	H	Uppercase H
9		Horizontal tabulation	I	73	I	Uppercase I
10		Line feed	J	74	J	Uppercase J
11		Vertical tabulation	K	75	K	Uppercase K
12		Form feed	L	76	L	Uppercase L
13		Carriage return	M	77	M	Uppercase M
14		Shift out	N	78	N	Uppercase N
15		Shift in	O	79	O	Uppercase O
16		Data link escape	P	80	P	Uppercase P
17		Device control 1 (X-ON)	Q	81	Q	Uppercase Q
18		Device control 2	R	82	R	Uppercase R
19		Device control 3 (X-OFF)	S	83	S	Uppercase S
20		Device control 4	T	84	T	Uppercase T
21		Negative acknowledge	U	85	U	Uppercase U
22		Synchronous idle	V	86	V	Uppercase V
23		End of transmission block	W	87	W	Uppercase W
24		Cancel	X	88	X	Uppercase X
25		End of medium	Y	89	Y	Uppercase Y
26		Substitute	Z	90	Z	Uppercase Z
27		Escape	[	91	[	Opening bracket
28		File separator	\	92	\	Reverse slant
29		Group separator	]	93	]	Closing bracket
30		Record separator	^	94	^	Circumflex
31		Unit separator	_	95	—	Underscore
32		Space (Blank)	`	96	`	Grave accent
33	!	Exclamation point	a	97	a	Lowercase a
34	"	Quotation mark	b	98	b	Lowercase b
35	#	Number sign	c	99	c	Lowercase c
36	$	Dollar sign	d	100	d	Lowercase d
37	%	Percent sign	e	101	e	Lowercase e
38	&	Ampersand	f	102	f	Lowercase f
39	'	Apostrophe	g	103	g	Lowercase g
40	(	Opening parenthesis	h	104	h	Lowercase h
41	)	Closing parenthesis	i	105	i	Lowercase i
42	*	Asterisk	j	106	j	Lowercase j
43	+	Plus	k	107	k	Lowercase k
44	,	Comma	l	108	l	Lowercase l
45	-	Hyphen (Minus)	m	109	m	Lowercase m
46	.	Period (Decimal)	n	110	n	Lowercase n
47	/	Slant	o	111	o	Lowercase o
48	0	Zero	p	112	p	Lowercase p
49	1	One	q	113	q	Lowercase q
50	2	Two	r	114	r	Lowercase r
51	3	Three	s	115	s	Lowercase s
52	4	Four	t	116	t	Lowercase t
53	5	Five	u	117	u	Lowercase u
54	6	Six	v	118	v	Lowercase v
55	7	Seven	w	119	w	Lowercase w
56	8	Eight	x	120	x	Lowercase x
57	9	Nine	y	121	y	Lowercase y
58	:	Colon	z	122	z	Lowercase z
59	;	Semicolon	{	123	{	Opening (left) brace
60	<	Less than	|	124	|	Vertical line
61	=	Equals	}	125	}	Closing (right) brace
62	>	Greater than	~	126	~	Tilde
63	?	Question mark	delete	127		Delete

Notes: 1. The equivalent EBCDIC character uses a different graphic.
2. No equivalent character exists in EBCDIC.

CEGEP
JOHN ABBOTT
COLLEGE

P.O. Box / C.P. 2000
Ste. Anne de Bellevue, Québec
H9X 3L9
Tel. (514) 457-6610

Le 23 février 1979.

Monsieur Gilles St-Pierre,
Service des Programmes,
Ministère de l'Education,
Complexe G,
18ième étage,
1035 de la Chevrotière,
Québec, Québec.
G1R 5A5.

Sujet: Enseignement assisté par ordinateur
Votre référence: 14-17-00.

Monsieur,

Je désire, par la présente, vous faire parvenir une proposition pour la prolongation du projet cité en rubrique.

Ce projet fut présenté et discuté par notre commité de recherche et développement et nous sommes convaincus que cette demande est raisonnable pour la conclusion de ce travail.

En tant que directeur des services pédagogiques, je tiens à vous assurer de mon entier appui à cette demande étant donné l'importance de ce travail pour le collège.

Veuillez agréer, monsieur, l'expression de nos sentiments distingués.

Gérald J. Bissett
Directeur des services pédagogiques

/ne

p.c.

PROPOSITION POUR LA PROLONGATION DU PROJET

ENSEIGNEMENT ASSISTE PAR ORDINATEUR (EAO)

Enseignement Complémentaire et Individualisé du Calcul(ECIC)

Auteur : N. Arganski

Suppléant : R. Mearns

Traduction: Agence E. Turner

Le 27 février 1979

PHASE V et VI

Description

Nous proposons que les Phases V et VI constituent plus spécifiquement une extention du projet sus-mentionné. Les Phases I et II de ce projet ont déjà été complétées et ont fait l'objet d'essais pratiques en classe. Ces essais ont été fait sur un ordinateur HP 2000 access system (rapport ci-inclus).

Phase V

Tracés des Fonctions de Mathématiques

Bien que ce soit une méthode ancienne, celle-ci est néanmoins respectée par le fait même que pour mieux comprendre une fonction il est sans aucun doute préférable d'en faire un tracé.
Des traceurs commerciaux sont normalement utilisés pour un tel travail. Nous comptons donc utiliser pour ce projet une terminale "multi-purpose" telle que la DIABLO ou la DTC 300 pour tracer des graphiques. Ceci coutera environs $3000.00 pour la terminale.

Phase VI

Cette phase utilisera les programmes déjà developpés dans les 5 phases précédentes, afin de rédiger non seulement des essais, mais aussi de les pourvoir d'une clef à leur solution. Ceci individualisera les épreuves soumises en classe, et aidera plus spécialement les étudiants désireux de rédiger eux-mêmes des programmes.

Coût des Phases V et VI

Nous estimons que le coût des deux phases s'élevera à environ $5000.00.
Nous vous prions de vous référer aux pages qui suivent pour plus de détails eu égard aux Phases V et VI.

./..

PHASE V

TRACES DES FONCTIONS DE MATHEMATIQUES

Proposition :
La planification et l'exécution d'un programme ayant pour but de tracer des fonctions de mathématiques.

Historique :
Depuis plusieurs années déjà les professeurs de mathématiques ont essayé de persuader leurs étudiants de "représenter" les diverses fonctions avec lesquelles ils devaient travailler. Cette "représentation" n'est pas une nouvelle méthode en pédagogie, mais plutôt une méthode connue et respectée.
Malheureusement, son exécution a été entravée par le travail souvent ingrat occasionné par l'évaluation des fonctions, sans compter les erreurs assez importantes produites lorsque les tracés étaient effectués à la main. Les avantages de cette représentation l'emportent de loin sur le temps consacré par les étudiants pour les produire.

Il existe actuellement des programmes capables de reproduire des tracés sur terminale télétype.

Ces terminales sont capables de produire des tracés pouvant être intégrés dans des dimensions en deça de 8 pces de large, avec une résolution de 10 caractères par pouce horizontalement et 6 c.p.p. verticalement.

Ces programmes existent dans la bibliothèque "software" des ordinateurs H.P. 2000.

Ces programmes, cependant, laissent beaucoup à désirer

Le manque de résolutions raffinées a affecté l'étude des courbes, ainsi que la compréhension des calculs par les étudiants.

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But de la Phase V du Projet

L'introduction de ce projet vise à développer un programme qui devra :

1. Accepter la définition de n'importe quel calcul de fonctions.
2. Evaluer les fonctions.
3. Exécuter le tracé en utilisant une terminale de haute résolution telle que la Diablo ou la DTC 300. Une sous-routine pourrait être intégrée pour que le tracé soit exécuté par un traceur commercial. Ces machines sont couteuses: $6500.00 contre $3000.00 pour une terminale DTC 300. En plus, les traceurs ne peuvent servir comme terminales régulières, alors que cela est possible avec la Diablo. Nous possédons présentement une terminale Diablo à John Abbott, de 60 c.p.p. horizontalement, et 48 c.p.p. verticalement.

Détails d'Exécution

Le programme devra :

1. Exécuter plusieurs fonctions sur un tracé.
2. Emmagasiner les fonctions qui y sont intégrées pour permettre la réutilisation d'un tracé.
3. Accepter des fonctions et vérifier les syntaxes qui y sont portées. Les erreurs de syntaxes seront décrites au fur et à mesure que les fonctions sont introduites.
4. Pourvoir une liste complète des fonctions de mathématiques standards, tels que : logarithmes naturels et communs, fonctions trigonométriques et leurs inverses, racines carrées, valeur absolue, integer, et fonctions exponentielles.

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5. Donner à celui qui s'en sert le contrôle total des dimensions et de l'échelle du tracé proprement dit. (Après avoir spécifié le Domaine de la fonction, le programme donnera à celui qui s'en servira une idée exacte de sa portée, et ainsi lui permettra d'en choisir une qui convienne au tracé.)
6. Permettre à celui qui s'en servira de tracer des points individuels seulement, ou bien de joindre ces points par des lignes droites.
7. Assurer que le dispositif de débit et non le programme déterminera la résolution du tracé.
8. Pourvoir au programme un manuel de mode d'emploi.

Application du Programme - Essai

Le programme sera mis à l'épreuve par la classe de calcul 103, et une comparaison sera faite entre les étudiants qui s'en serviront, et ceux qui ne s'en serviront pas Ceci donc déterminera le degré de compréhension de l'étudiant eu égard au comportement des fonctions de calcul élémentaire.
Si cette expérience réussit le programme sera remis à la bibliothèque communale de John Abbott, et sera disponible aux disciplines diverses, leur permettant au besoin de s'en servir pour tracer des graphiques.

Phase VI

LA PRODUCTION PAR ORDINATEUR D'EPREUVES ET D'EXAMENS DE CAL 1 (CPTE)

Pédagogie

Il a été reconnu depuis déjà quelque temps que pour obtenir les meilleurs résultats possibles dans le domaine de l'enseignement, il faut absolument corriger les corrections d'erreurs aussitôt qu'elles sont commises - en d'autres termes, avant qu'elles ne s'introduisent dans le sub-conscient comme réactions positives.

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Dans ce projet (enseignement complémentaire et individualisé de calcul) on a développé des méthodes d'enseignement pouvant démontrer à l'étudiant la nature de sa réponse.

Il est cependant important de différencier les deux stages de base de l'enseignement:

a) l'acquisition de connaissances;
b) la compétence de performance (démonstration de la compréhension)

afin d'éviter que cette dernière ne nuise à la première, car cela pourrait produire un sentiment de peur, ce qui provoquerait des réponses initiales erronées.

Les 5 premières phases de ce projet porteront sur le stage acquisitif de l'enseignement.
Phase VI développera une méthode d'examens pouvant efficacement déceller le degré de compétence quel que soit le sujet.

Méthodes

Une étude approfondie sera faite des conceptes du projet CGIPS (Computer Generated Individualized Problem Sets) qui a été développé à la faculté de chimie à John Abbott College. En plus, des nouveaux programmes y seront introduits.
Ces programmes permettront l'utilisation des facilités de résolution de problèmes qui ont été développées dans les 5 premières phases de ce projet.

Caractéristiques de CPTEC

1. Le débit immédiat d'épreuves et d'examens de Cal 1.
2. Le sélectionnement de problèmes plus ou moins difficiles.
3. Des réactions immédiates sur la performance.
4. Des examens individualisés.
5. Chaque examen sera pourvu de sa solution complète.

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EMPLOI DU TEMPS

Il est estimé que les Phases V et VI commenceront en Septembre 1979, et termineront en Juin 1980.
Il est prévu que Phase V prendra 430 h.h. et Phase VI 535 h.h.s.

Coût

Programmation & Coding - Phase V	$1600.00	Phase VI: $2000.00
Secrétariat	200.00	200.00
Logement et Déplacement	500.00	500.00
	$2300.00	$2700.00

TOTAL : $5000.00

CEGEP
JOHN ABBOTT
COLLEGE

P.O. Box / C.P. 2000
Ste. Anne de Bellevue, Québec
H9X 3L9
Tel. (514) 457-6610

le 27 février 1979.

Monsieur Gilles St-Pierre,
Service des programmes,
Ministère de l'éducation,
Complex G, 18ième étage,
1035 de Lachevrotière,
Québec, Québec G1R 5A5

Monsieur,

Enseignement assisté par ordinateur
Rapport intérimaire - Votre réfèence: 14:17:00

Veuillez, je vous prie, accepter mes profondes excuses pour le retard que j'ai mis à vous soumettre ce rapport. L'argumentation qui vous est ici soumise vous démontrera que la responsabilité n'en est pas entièrement la mienne.

Les documents suivants sont ci-inclus:

a) Le rapport intérimaire
b) Une lettre du Directeur des services pédagogiques
c) Une proposition pour la prolongation du projet en rubrique

Agréez, je vous prie, l'expression de mes sentiments les meilleurs.

CEGEP JOHN ABBOTT

Nikolai Arganski,
Auteur du projet.

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p.j.